PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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PRINCIPAL CONTENTS

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		PAGE
51	**MATHEMATICS**	145
52	**ASTRONOMY. ASTROPHYSICS. GEODESY**	145
53	**PHYSICS**	148
530.1	**Fundamentals**	148
530.145	Quantum theory	148
531	**General mechanics. Mechanics of solids**	149
531.7	**Mechanical measurements**	149
532	**Mechanics of liquids**	150
532.6	**Capillarity** No abstracts	
532.7	**Kinetic theory of liquids**	151
533	**Mechanics of gases**	151
533.7	**Kinetic theory of gases** No abstracts	152
534	**Vibrations. Acoustics**	152
534.2	Propagation	152
534.321.9	Ultrasonics	153
534.8	Architectural acoustics	153
535	**Optics. Radiation. Spectra**	153
535.33/.34	Spectra	154
535.34	Absorption	155
535.37	Luminescence	155
535.375.5	Raman effect	156
535.4	Interference. Diffraction	156
535.43	Scattering	157
535.6	Colour	157
535.8	Optical instruments	157
536	**Heat**	158
536.2	Conduction. Heat transfer	158
536.48	Low temperature phenomena	158
535.65	Latent heats	158
536.7	**Thermodynamics**	158
537	**Electricity**	158
537.226	Dielectrics	159
537.3	**Electric currents**	159
537.5	**Electric discharges and radiations**	160
537.533	Cathode rays	162
537.542	Counters	162
537.591	**Cosmic rays**	163
538	**Magnetism**	164
538.3/.5	**Electromagnetism. Electrodynamics**	164
538.6	**Magnetic effects**	165
539	**Atomic and molecular structure**	165
539.152.1	Nucleus	165
539.155.2	Isotopes	166
539.16/.18	**Radioactivity. Nuclear disintegration. Nuclear particles**	166
539.172	Nuclear transmutation	168
539.18	Neutrons. Mesons	169
539.2	**Structure of solids**	170
539.3/.8	**Elasticity. Strength. Rheology**	170
541	**PHYSICAL CHEMISTRY**	171
541.121/.123	**Phase equilibrium**	171
541.124/.128	**Reaction kinetics**	171
541.18/.182	**Colloids. Disperse systems**	171
541.183	**Adsorption**	172
541.2	**Atomic theory**	172
541.4/.6	**Chemical structure**	172
542.1/.7	**Chemical apparatus**	172
543/545	**Chemical analysis**	172
548	**CRYSTALLOGRAPHY**	173
549	**Mineralogy**	174
55	**GEOPHYSICS**	174
551.5	**Atmosphere. Meteorology**	174
57/59	**BIOLOGY**	175
61	**Medical science. Human physiology**	175
666	**Glass. Ceramics**	176
669	**Metallurgy**	176
77	**PHOTOGRAPHY**	176

The headings printed in bold type will be found in the text. The others may be located by their U.D.C. number.

RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

Mechanical testing
Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21: 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0: 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

.3 : 53.081.5 = 3 *see Abstr.* 1417

.12 : 531.111 = 4 *see Abstr.* 1440

.941 1382

The logarithmic solutions of linear differential equations. BRUIJN, N. G. *Phil. Mag.*, **39**, 134–40 (*Feb.*, 1948).

.42 : 512.3 1383

The use of the slide rule in the numerical solution of ations. WALKER, R. M. *Phil. Mag.*, **38**, 740–7 (*Oct.*, 47).—The method is discussed and illustrated by solving ne algebraic equations of degrees 2, 3 and 4, and ations of the type $xe^{ax} = b$. L. S. G.

.2 = 4 1384

Notes on the "energy" properties of random functions. BLANC-LAPIERRE, A. *C.R. Acad. Sci., Paris*, **225**, 982–8 (*Nov.* 24, 1947) *In French.*—Certain developments of theoretical harmonic analysis, using analogies with physical concepts. N. L. J.

519.2 : 530.145.6 = 4 *see Abstr.* 1438

519.24 = 4 1385

Determination of the most probable value of statistical parameters. I. General. ALLARD, G. *J. Phys. Radium* (*Sér.* 8) **8**, 212–14 (*July*, 1947) *In French.*—Results equivalent to the well-known maximum likelihood formulae are obtained from certain inverse probability postulates. N. L. J.

519.25 : 53.088 = 4 *see Abstr.* 1419

ASTRONOMY . ASTROPHYSICS . GEODESY 52

.041 : 539.155.2 1386

Astrophysical evidence for the probability of a nuclear ction. SCHATZMAN, E. *Astrophys. J.*, **107**, 111 *n.*, 1948).—The reaction $H^1 + H^1 = D^2 + e^+$ is con- ered in relation to energy production in an H shell. is concluded that the reaction is consistent with the ory of white dwarfs. R. A. N.

.042 1387

On the formation of heavy elements in stars. HOYLE, F. *c. Phys. Soc., Lond.*, **59**, 972–8 (*Nov.*, 1947).—Suitable nditions occur on the contraction of massive stars. ements are distributed in interstellar space by outbursts sing from rotational instability. R. A. N.

1.042 : 539.155.2 1388

On the relative abundances of nuclei in the universe. TOLEDO, P. S., AND WATAGHIN, G. *Phys. Rev.*, **73**, 80 (*Jan.* 1, 1948).—Using a formula previously blished [Abstr. 1487 (1946)] for the abundance of an m of given Z and A, and choosing reasonable values the parameters therein, an abundance curve is obtained good agreement with Goldschmidt's data. W. E. D.

2.615 : 535.247.3 1389

A theoretical discussion of the ultimate limits of astro- mical photo-electric photometers. JOHNSON, H. L. *trophys. J.*, **107**, 34–47 (*Jan.*, 1948).—This paper dis- sses the sources of error in photoelectric photometry, ves suggestions for improving performance, and states e limits available with components in the near future. bibliography of modern books is given. E. G. M.

3.11 = 3 1390

On cosmogony. VON WEIZSÄCKER, C. F. *Z. Astrophys.*, (*Nos* 1–2) 181–206 (1947) *In German.*—The morphology celestial objects of all sizes suggests 3 groups: spheres, ures of rotation and clouds. Clouds result from a state turbulent motion postulated in the primeval gas. rts of the turbulent gas give rise to figures of rotation hich on account of internal friction later degenerate into slowly rotating nucleus and a residue dissipating the eater part of the angular momentum. From estimates the time-scale of these processes it is concluded that tating systems are relatively young. Elliptical and herical galaxies are genetically older than spirals; egular nebulae are the youngest of all. Spiral structure sults from the interaction between rotation and tur- ilent cloud formation. Stars of types O, B and A are, account of their rapid rotation, young, the transition the older main-sequence stars being by loss of mass d angular momentum. A. HU.

523.11 : 523.877 = 3 1391

Determination of the ages of stars, remarks on Jordan's cosmology. TEN BRUGGENCATE, P. *Z. Astrophys.*, **24** (*Nos* 1–2) 48–58 (1947) *In German.*—Assuming that energy is generated in main series stars by the conversion of H into He, stellar ages are estimated from present luminosities. If the constant of gravitation G is independent of the age t of the Universe, the original H-content of a star must be chosen to give a stellar age consistent with t. The transformation of 3% H into He would make the sun's age $3{\cdot}6\times10^9$ years, but radiation would cease after $17{\cdot}5\times10^9$ years. In Jordan's cosmology $G \simeq 1/t$, and estimates of stellar ages are shown to depend upon t; the observed He-content gives the above age for the sun if $t = 6{\cdot}5\times10^9$. As t increases, the H-content tends to a limiting value $\sim$59%, and radiation may continue indefinitely. "Old" stars will have practically the same chemical constitutions. R. A. N.

523.11 : 537.591 = 3 1392

Theory of star-genesis. JORDAN, P. *Phys. Bl.*, **3** (*No.* 4) 97–106 (1947) *In German.*—Most matter in the cosmos exists in the form of stars. With few exceptions, the star masses lie in the range of 0·1–50 sun masses, and the author seeks to explain this apparent mass limit by considering various theories of star-formation. The formation of stars by gravitational condensation of "gaseous matter" of spiral nebulae is unlikely, since spiral nebulae have lately been proved to consist of stars only. A definite upper mass limit of 1·44 sun masses is obtained by Chandrasekhar's theory of nova formation. Another theory yields the result that stars beyond a certain mass contract and become unable to emit or absorb light, and thus disappear from the cosmos. The effect of a variation of the gravitational "constant" F with time is then investigated. If $F \propto t^{-1}$, the theoretical model corresponds well with empirical data of the cosmos. The hypothesis that $F \propto t^{-2}$ can be used to explain the formation of matter in the form of stars. Cosmic ray origin and the distribution of the elements in the cosmos is also discussed. V. W. R.

523.162 : 523.854.12 *see Abstr.* 1410

523.165 1393

Variable source of radio frequency radiation in the constellation of Cygnus. BOLTON, J. G., AND STANLEY, G. J. *Nature, Lond.*, **161**, 312–13 (*Feb.* 28, 1948).—Observation with a radio "interferometer" showed the source in Cygnus to be $<8'$ angular width, and its point of origin was determined fairly closely. Two components, one constant and the other varying, could be distinguished.

523.21 1394

On the law of planetary distances. SCHMIDT, O. J. *C.R. Acad. Sci. URSS*, **52** (*No.* 8) 667–72 (1946).—The author's meteoritic hypothesis of planetary formation is used to derive theoretically two laws of planetary distances, in each of which the square roots of the orbital radii for the successive planets form an arithmetic progression. The constants of the progressions differ for the two laws, which refer to two groups constituting respectively the major and the terrestrial planets. The representation is better than that by Bode's law. A. HU.

523.36 : 538 = 4 1395

On the magnetism of celestial bodies. DAUVILLIER, A. *C.R. Acad. Sci., Paris*, **225**, 839–41 (*Nov.* 10, 1947) *In French.*—The magnetic moment of the moon is estimated as 17×10^{23} c.g.s., using the author's theory of planetary magnetism [Abstr. 995 (1943)]; this is $10^3 \times$ the moment deduced from Blackett's relation. It is suggested that planetary magnetism is not related to rotation. R. A. N.

523.4 : 523.73 *see Abstr.* 1401

523.5 : 621.396.9 1396

Combined radar, photographic and visual observations of the Perseid meteor shower of 1947. MILLMAN, P. M., MCKINLEY, D. W. R., AND BURLAND, M. S.; LOVELL, A. C. B. *Nature, Lond.*, **161**, 278–80 (*Feb.* 21, 1948).—On the nights of Aug. 9–14, 3 700 radar echoes, 1 100 visual meteors and 20 meteor photographs were simultaneously recorded; 101 radar echoes coincided with visual meteors; 54 visual meteors gave no radar echoes. Six types of radar echo were distinguished, and their origins are discussed.

523.72 1397

Emission of enhanced microwave solar radiation. GIOVANELLI, R. G. *Nature, Lond.*, **161**, 133–4 (*Jan.* 24, 1948).—A theory is outlined to explain the "million degree" radiation from the neighbourhood of sunspots. It is shown how electrons may obtain energies of 10^6–10^7 eV near a rapidly growing sunspot field; the energy radiated by such electrons spiralling round the lines of force is estimated.

523.72 : 523.746 1398

Solar radio emission and sunspots. THOMSEN, I. L.; RYLE, M. *Nature, Lond.*, **161**, 134–6 (*Jan.* 24, 1948).—Ryle and Vonberg's extended observations on the ratio of 80 to 175 Mc/s activity [Abstr. 2760 (1947)] show a remarkable correlation with sunspot groups; groups in the earliest stages of vigorous development give the greatest emission, and the received energy is greatest somewhere near the time of central meridian passage. Ryle confirms, on the basis of observations extending over 12 solar rotations, the existence of periodicities of 27·9, 27 and 26·3 days.

523.72 : 551.510.535 = 3 1399

The *F*-radiation of the sun. I. BURKARD, O. *Acta Phys. Austriaca*, **1** (*No.* 1) 98–102 (1947) *In German.*—Critical frequencies f for the ionospheric F_2-layer, observed 1940–44 at Kochel in Bavaria (hourly monthly means), compared with the characteristic numbers $\bar{K}$ of the Ca flocculi give an average correlation coefficient of 95%. Assuming a linear relation $f = aT_0 + b$ between f and the intensity T_0 of the solar radiation acting on the F-layer, the correlation coefficient between the monthly means of T_0 and $\bar{K}$ for the above period becomes $0{\cdot}970 \pm 0{\cdot}008$. A. B.

523.72 : 551.521.1 : 621.396.82 1400

Audio-frequency radio waves from the sun. MENZEL, D. H., AND SALISBURY, W. W. *Nature, Lond.*, **161**, 91 (*Jan.* 17, 1948).—The existence of low-frequency (500 c/s) radiation from pulsations of sunspot magnetic fields is suggested. This might account for many solar and terrestrial phenomena (night sky luminosity, auroræ as it would be diffracted round the earth to the dark side and may also be responsible for ionospheric storms and even cosmic rays. Preliminary experiments with a large loop aerial and a.f. amplifier have detected variations of the order of 0·01–1·0 V/cm and of frequencies 25–400 c/s.

523.73 : 523.4 140

On the origin of the sun's rotation. SCHMIDT, O. *C.R. Acad. Sci. URSS*, **54** (*No.* 1) 15–18 (1946).—It is suggested that the sun at one time, while crossing the central plane of the galaxy, met a cloud of cosmic dust and meteorites. A portion of the cloud was captured by the sun and compelled to revolve about it as a meteoric swarm. Segregation in the swarm gave rise to the planets. Some meteorites fell into the sun and imparted to it the angular momentum. This theme is developed and it is computed that the direction and magnitude of the sun's rotational momentum may be explained by the fall of these meteorites. L. S.

523.746 140

Magneto-hydrodynamic waves and sunspots. II. ALFVÉN, H. *Ark. Mat. Astr. Fys.*, **34A** (*Paper* 23) 20 *pp.* (1947).—Whirl rings [Abstr. 3013 (1947)] generated by convection in the solar core are produced, not in the equatorial plane, but in 2 active regions near the N. and S. boundaries of the convective zone. The 11-yr period is identified as the transit time of waves between these regions. The theory accounts for the observed negative correlation between length and intensity of a spot cycle and predicts a correlation between the occurrence of activity at a given latitude in one cycle and at the opposite latitude in the preceding cycle. A statistical investigation confirms that such a correlation exists. A. H.

523.746 : 523.72 *see Abstr.* 1398

523.746 : 538.615 = 3 140

On the discovery of weak magnetic fields on the sun's surface. VON KLÜBER, H. *Z. Astrophys.*, **24** (*Nos* 1–2) 1–21 (1947) *In German.*—Using a quartz plate and a polaroid in front of the slit of the grating spectrograph (focal length 12 m, dispersion 0·7 Å/mm) of the Potsdam Solar Tower, magnetic fields of 20–40 gauss have been measured. The quartz plate gives a phase shift of $\lambda/4$ and $3\lambda/4$ for a suitable pair of lines. Circular polarized components of the Zeeman pattern are thus transformed into linear orthogonal polarized ones. Suitable rotation of the polaroid gives spectra in which the distance of the lines becomes: $\lambda_1 - \lambda_2 + 2\Delta\lambda$ and $\lambda_1 - \lambda_2 - 2\Delta\lambda$ ($\Delta\lambda$ = Zeeman separation). Optical methods for selecting the plate thickness and testing the instrument are described, also an important device with two polaroids, quartz plate, $\lambda/4$ plate and compound $\lambda/2$ plate. A.

523.746 : 538.615 = 3 140

On the discovery and measurement of local magnetic fields on the surface of the sun. VON KLÜBER, H. *Z. Astrophys.*, **24** (*Nos* 1–2) 121–80 (1947) *In German.*—An extensive report on the work in progress since 1942 with the Potsdam Solar Tower on the Zeeman effect in sunspots. The autocollimating grating spectrograph [Abstr. 1403 (1948)] and a compound $\lambda/4$ plate with polaroid in front of the slit were used. Observational technique and sources of errors are discussed. Tables of suitable lines are given. Photometric intensities across the spot are measured on direct photographs and compared with the distribution of magnetic field intensities. Bibliography up to 1947. A.

.77 = 3 1405

Hydrogen in the spectrum of the sun. ROSA, A. *Z. rophys.*, **24** (*Nos* 1–2) 38–47 (1947) *In German.*—files of H_α and H_γ, of HeD_3, and of the Balmer ontinuity are calculated on the basis of Strömgren's del of the solar atmosphere. Comparison with ervations reveals deviations from thermodynamical ilibrium for layers of small optical depth. A. B.

.775.2 1406

Quantitative analysis of the spectrum of an eruptive minence. UNSÖLD, A. *Z. Astrophys.*, **24** (*Nos* 1–2) 37 (1947) *In German.*—From microphotometric nsity measurements of 63 lines (H, HeI, HeII, MgI, , TiII, CrII, FeI, SrII) in a solar eclipse spectrum, the nbers of emitting atoms in the higher atomic state are ermined. Excitation functions $\phi(\chi)$ are derived from Saha equation for these atoms and ions. For an ization potential of 0–10 V, $\phi(\chi)$ gives an excitation perature $T = 5\,000°$K; 15–20 V give 50 000°K. diation pressure can neither explain the equilibrium quiescent, nor the dynamics of eruptive prominences. e great intensity of He-lines in prominences, υ Sagitii, α Cygni and in other *c*-stars appears to be not an ndance but an over-excitation effect. A. B.

.821 1407

The determination of magnitudes by comparison with a ndard field. WEAVER, H. F. *Astrophys. J.*, **106,** 366– (*Nov.*, 1947).—Describes a reduction method which umes a point of optimum density at which the effects small changes of seeing, focus, and guiding (systematic le errors) are negligible. Changes in seeing, etc., ate the reduction curves about this point and the ount of this rotation for unequal exposure times of mparison and standard field is discussed. Much ditional work is deemed desirable. E. G. M.

.838 : 523.877 1408

On stellar rotation. II. SCHWARZSCHILD, M. *Astro- s. J.*, **106,** 427–56 (*Nov.*, 1947).—Continuing previous rk [see Abstr. 2245 (1942)], a numerical solution is tained for a slowly rotating star consisting of a con- tive core in solid-body rotation and a radiative envelope e of large-scale convection. The effect of slight riations from constancy of the angular velocity of the re is investigated and shown to be small. The solution es an equatorial surface acceleration in qualitative reement with solar observations, but twice as large as t observed. R. A. N.

.84 : 523.87 *see Abstr.* 1413

.851.2 = 3 1409

On the origin of globular clusters. VON DER PAHLEN, E. *Astrophys.*, **24** (*Nos* 1–2) 68–120 (1947) *In German.*—ggests that compact clusters might be formed by con- ction from star clouds of small density. The known nsity distribution in M 92 [see Abstr. 1554 (1939)] is ed to determine the density in the primitive star cloud, ich is assumed to be initially at rest. The density of cloud is found to be approximately uniform, and the e for the formation of the cluster $\simeq 10^6$ to 10^8 years. e effect of small initial velocities in the star cloud is nsidered. The motion of stars in open clusters is also cussed. R. A. N.

.854.12 : 523.162 1410

An extension of the interstellar absorption curve. HITFORD, A. E. *Astrophys. J.*, **107,** 102–5 (*Jan.*, 48).—Preliminary results of the radiation of 4 space- ddened stars are given. These measures, made at 90 μ and 2·1 μ, form an extension into the infrared beyond the previously observed region from 0·35 μ (ultraviolet) to 1·0 μ. Conclusions are drawn from these results as to the nature of the absorbing particles and as to the ratio between total absorption and colour excess. The value of infrared surveys in regions of dust clouds is stressed, but final conclusions depend upon further investigations. E. G. M.

523.87 1411

The Balmer discontinuity in the spectrum of HD 190073. STRUVE, O. *Astrophys. J.*, **106,** 358–61 (*Nov.*, 1947).—The discontinuity D, as defined by Barbier and Chalonge, is found to have the unusually large value of 0·84. This is probably related to other spectrum peculiarities, particularly the metallic emission, but no complete explanation is yet available. D. L. E.

523.87 1412

The higher members of the ($2^3P^0 - n^3D$) series of HeI in the spectrum of 55 Cygni. STRUVE, O., AND CHUN, H. *Astrophys. J.*, **107,** 109–10 (*Jan.*, 1948).—Flatter contours for the highest measurable members of this series, compared with earlier members, suggests that Stark broadening is not negligible even in this early-type supergiant. D. L. E.

523.87 : 523.84 1413

High dispersion spectra of υ Sagittarii. GREENSTEIN, J. L., AND ADAMS, W. S. *Astrophys. J.*, **106,** 339–57 (*Nov.*, 1947).—Wavelengths and identifications are given for about 1 000 lines between 3 564 and 4 861 Å. The behaviour of different elements (as regards line intensities, contours and radial velocities) is discussed in relation to possible underlying physical processes. D. L. E.

523.877 1414

On the radiative equilibrium of a stellar atmosphere. XXII. CHANDRASEKHAR, S. *Astrophys. J.*, **107,** 48–72 (*Jan.*, 1948).—Continues discussion of diffuse reflection and transmission. Exact solutions have same form as in XXI [Abstr. 18 (1948)], but with $X(\mu)$, $Y(\mu)$ redefined as solutions of a pair of simultaneous functional equations; these solutions are not uniquely defined for particular problems, but ambiguity may be removed by consideration of the flux integrals. R. A. N.

523.877 = 4 1415

The distribution of the elements in a non-isothermal atmosphere. SCHATZMAN, E. *C.R. Acad. Sci., Paris,* **225,** 990–1 (*Nov.* 24, 1947) *In French.*—Expressions are found for the distribution of ionized elements and electrons in a non-isothermal atmosphere. The results are considered in their application to the H atmosphere of white dwarfs. It is concluded that in the absence of any other phenomena the concentration of heavy elements at the surface of white dwarfs would be imperceptible. The presence of Ca^+ in Van Maanen 2 suggests the possibility of an Unsöld convective layer by which heavy elements are brought to the surface where they appear in the spectrum. F. E. H.

523.877 : 523.11 = 3 *see Abstr.* 1391

523.877 : 523.838 *see Abstr.* 1408

523.877 : 539.152.1 1416

On the formation of chemical elements inside the stars. WATAGHIN, G. *Phys. Rev.*, **73,** 79 (*Jan.* 1, 1948).—The conditions are discussed which would permit nucleons in the interior of stars to condense into nuclei and it is shown that such a condensation could take place for a temp. corresponding to $kT \sim 4\times10^7$ eV and a density $\sim 10^{13}$ g/cm^3. W. E. D.

53.081.5 : 512.3 = 3 1417

Use of equality signs. POHL, R. W., AND STÖCKMANN, F. *Z. Phys.*, **122** (*Nos* 9–12) 680–5 (1944) *In German.*—Discusses the use of equality signs (=) in dimensional equations and shows how this may lead to errors. The authors recommend the use of a "corresponds to" sign (≙) and give examples. V. W. R.

53.088 = 4 1418

Fundamental concepts of the technique of measurement. HARTMANN, J. *Rev. Sci., Paris*, **85**, 323–34 (*April* 1, 1947) *In French.*—The idea of measurement as a production, analogous to an industrial production, of which the product is an image in figures of the property measured, is developed. The terms, *uncertainty* (incertitude), *error* (faute), *tolerance*, in relation to the production, and *indeterminacy*, *falsification*, in relation to the product, are clearly defined. The relationships between these are explained and illustrated by examples. It is shown that the uncertainty of production is manifested by the indeterminacy of the product, i.e. by oscillatory deviations from a mean value, whereas the error of production is manifested by the falsification of the product, i.e. by a unilateral deviation. S. W.

53.088 : 519.25 = 4 1419

On the representation of an experimental law by an approximate law and a curve of deviation. VERNOTTE, P. *C.R. Acad. Sci., Paris*, **223**, 1105–7 (*Dec.* 23, 1946) *In French.*—A discussion of the treatment of errors in the values of quantities determined by experiment. It is shown how the curve of deviation allows the experimental values to be regularized. L. S. G.

FUNDAMENTALS 530.1

530.12 1420

Discrete space-time and integral Lorentz transformations. SCHILD, A. *Phys. Rev.*, **73**, 414–15 (*Feb.* 15, 1948).—To remove the infinities occurring in modern physical theories, a discrete space-time is proposed which is invariant under some, but not all, Lorentz transformations. A serious drawback of the scheme is that the smallest non-zero velocity is 0·866× the velocity of light. W. E. D.

530.12 : 531.18 = 4 1421

Recent experimental verifications of the special theory of relativity. LENNUIER, R. *Rev. Sci., Paris*, **85**, 740–8 (*July* 15, 1947) *In French.*—Reviews applications of the mass-velocity and mass-energy relations, and also applications of theory to moving "atomic clocks." [See Abstr. 3541 (1938), 1737 (1941)]. R. A. N.

530.12 : 531.51 = 3 1422

Extension of projective relativity. JORDAN, P. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 219–28 (*May*, 1947) *In German.*—Continues earlier work in which the constant of gravitation is treated as a field variable [Abstr. 2017 (1947)]. Affine differentiation is introduced, and the relation of equations in 5-space to those in 4-space is discussed in detail. R. A. N.

530.12 : 536.7 1423

Lorentz-like transformations. LANDSBERG, P. T.; DINGLE, H. *Nature, Lond.*, **161**, 208–9 (*Feb.* 7, 1948).—A general transformation is introduced of which those of Lorentz and Dingle [Abstr. 208 (1945), 62, 117 (1947)] are special cases.

530.12 : 539.165.2 : 530.145 = 4 *see Abstr.* 1430

530.14 142

On the Hamiltonian for a particle in an electromagneti field. RICHARDS, P. I. *Phys. Rev.*, **73**, 254 (*Feb.* 1 1948).—By subtracting a term $(e/c)(d/dt)(\boldsymbol{A}\,.\,\boldsymbol{r})$ fro the classical Lagrangian, deriving the correspondin Hamiltonian and carrying through a quantum mechanic contact transformation, the low frequency divergence are eliminated. W. E. D.

530.14 = 4 142

On certain quadratic relations in the theory of th photon. BLOCH, L. *C.R. Acad. Sci., Paris*, **223**, 1099 1100 (*Dec.* 23, 1946) *In French.*—The relation $\sigma_1 f_1 + \sigma_2 f_2 + \sigma_3 f_3 - \sigma_4 f_4 = 0$, where $\boldsymbol{\sigma}$ is the spin vector, an f the current, which holds for a Dirac particle, may b extended into a similar relation for the particle, e.g. photon, obtained by the fusion of two Dirac particles While the latter is not always valid, it is in the case o a plane monochromatic wave, and a proof of this i given. L. S. G.

530.14 = 4 142

Spinor space and the theory of sub-spinors. KWAL, B *C.R. Acad. Sci., Paris*, **223**, 1100–1 (*Dec.* 23, 1946) *I French.*—Spinor space is defined and some of its pro perties are developed. With the aid of semi-spinor equations of Dirac's type may be set up in this space Application may be made to the theory of particles wit spin. L. S. G.

530.14 = 4 142

Intensity and probability in space-time systems. GIÃO A. *Bol. Soc. Portuguesa de Mat.*, **1A** (*No.* 2 29–40 (1947) *In French.*—Continuing previous wor [Abstr. 2018 (1947)], a distinction is made betwee Laplacian and Hamiltonian systems according to th behaviour of wave functions with respect to linea operators. The concept of probability density is cor sidered and found to be applicable only in restricte regions of space. The influence of metric fields on wav functions is also considered. R. A. N.

530.145 142

Field theories with high derivatives. CHANG, T. *Proc. Camb. Phil. Soc.*, **44** (*Pt I*) 76–86 (1948).—Th relativistic field theories of elementary particles [Abstr. 2 (1942)] are extended to cases where the field equatio are derived from Lagrangians containing all derivativ of the field quantities. Formulae are obtained fo current, energy-momentum tensor, and angula momentum tensor, all of which may be made gaug invariant by a suitable subtraction procedure, when th field interacts with an electromagnetic field. Th Hamiltonian equations of motion are also given in gaug invariant form. L. S. G.

530.145 = 3 142

Remarks on an extension of the Born approximation collision problems. HEITLER, W. *Acta Phys. Austriaca*, (*No.* 2) 110–12 (1947) *In German.*—The Heitler-Per damping equation can be reduced to the Born approx mation or to an integral equation of a simple type whic is an extension of it. If applied to the scattering of particle in a meson potential field, this second approx mation is valid for a potential of small range and sma interaction constant. G. J. I.

530.145 : 530.12 : 539.165.2 = 4 143

The theory of fundamental particles. I. Elementa particles. GIÃO, A. *Portugal. Math.*, **6** (*Nos* 1–2) 67–1 (1947) *In French.*—The cosmology previously outline [Abstr. 2737 (1946), 2018 (1947)] is applied to find t

ncipal properties of the elementary particles, including croelectrons with charge and mass < that of the tron. β-decay is briefly discussed in terms of these. G. J. K.

).145 : 535.1 : 539.18 = 3 *see Abstr.* 1660

).145 : 537.122 *see Abstr.* 1542

).145 : 537.122 = 3 1431

On the Dirac theory of the electron. V. The Pauli matrix. KOFINK, W. *Ann. Phys., Lpz.* (*Folge* 6) **1** (6s 1–3) 133–6 (1947) *In German.*—Explicit formulae given for this matrix by using the symmetry of the ti-commuting γ-matrices. The matrix is needed in nection with the separation of the charge-conjugate ution of the Dirac equations. G. J. K.

).145 : 538.3 : 537.122 1432

On quantum-electrodynamics and the magnetic moment the electron. SCHWINGER, J. *Phys. Rev.*, **73**, 416–17 b. 15, 1948).—To deal with electrons of moderate rgy only, a new Hamiltonian is introduced which olves the experimental electron mass (i.e. electro- gnetic mass + mechanical mass) rather than the chanical mass, so that an electron interacts with the liation field only in the presence of an external field. is pointed out that this procedure does not eliminate the divergences. Detailed application of the theory es an additional magnetic moment $\delta\mu$ given by $/\mu = 0{\cdot}001162$, which is consistent with recent experi- nts [Abstr. 2614 (1947), 702 (1948)]. W. E. D.

).145 : 539.152.1 : 539.18 = 3 1433

Quantum theory of wave fields and a smallest length. II. RCH, A. *Acta Phys. Austriaca*, **1** (*No.* 2) 137–54 47) *In German.*—The theory previously outlined bstr. 521 (1948)], which introduces a shortest length l_0, first shown to be relativistically invariant. With the v source function only mesons of momentum $<(\hbar/l_0)$ be emitted by nucleons, so that nuclear forces remain te at zero distance and have a range l_0 rather than that ociated with the meson mass. Details are given for tor mesons, when the dependence of the force on tance and spin is complicated. The scattering of sons by nuclei at high energies is discussed. G. J. K.

).145.6 1434

On the solutions of radial wave equations. WINTNER, A. *vs. Rev.*, **73**, 91–2 (*Jan.* 1, 1948).—The solution of the dial Schrödinger equation is discussed in the case where potential energy is of the form

$$V(r) = Ar^{-a} + Br^{-b} + \ldots$$

W. E. D.

).145.6 = 4 1435

Proper values and interaction energy. SCHATZMAN, E. *h. de Phys.* (*No.* 28) 55–67 (*Sept.*, 1945) *In French.*—there is no initial degeneracy a perturbation potential completely determined by the perturbed and un- turbed energy levels and a matrix depending only on unperturbed wave-functions of the system on which acts. If there is degeneracy the potential is not com- tely determined without more information. G. J. K.

).145.6 = 4 1436

On two simple methods of integration in the wave chanics of a system. First integrals; small movements out a stable equilibrium position. VIARD, J. *Cah. de ys.* (*No.* 28) 68–96 (*Sept.*, 1945) *In French.*—The wave chanical concepts corresponding to first integrals in ssical mechanics are described and the operator con- ions for their use are obtained. The corresponding atment of the Lagrange method of small oscillations is nilarly discussed, and simple applications of all these as are made to a system of n particles. G. J. K.

530.145.6 = 4 1437

A simple procedure for the study of certain problems of time dependence, with application to the case of a free particle. D'ESPAGNAT, B. *C.R. Acad. Sci., Paris*, **225**, 1058–9 (*Dec.* 1, 1947) *In French.*—The problem considered is the time-dependence of the Laplace characteristic function [Abstr. 1795 (1946)] of a pair of operators whose Poisson bracket is constant. G. J. K.

530.145.6 : 519.2 = 4 1438

Probability laws in wave mechanics. ARNOUS, E. *J. Phys. Radium* (*Sér.* 8) **8**, 87–93 (*March*, 1947) *In French.*—Some aspects of wave mechanics are considered from the point of view of the theory of Hilbert Space, and it is pointed out that operators with continuous spectra are not bounded. In the theory now developed the classical formalism is reconciled with that of Neumann by replacing an operator $E(x)$ by its Fourier–Stieltjes transform, $U(s) = \int (\epsilon^{2\pi isx}\, dE(x)$, and the probability law, $\mu(x) = \int (\bar{\psi}E(x)\psi d\tau)$, by its transform, $\Phi(s) = \int (\epsilon^{2\pi isx}\, d\mu(x)$. A dynamical variable is now represented not by a transformation, $\psi(x) \to A\psi(x)$, where A is self-adjoint, but by a continuous group of unitary transformations, $\psi(x) \to U(s)\psi(x)$; and the probability law for this variable is given by $\Phi(s) = \int (\bar{\psi}U(s)\psi d\tau)$. The theory is developed, and 3 applications are discussed. Particles with spin cannot be discussed without some extension of the theory. L. S. G.

530.145.65 = 4 1439

On potentials and the gauge transformations in the theory of particles of spin 1. KWAL, B. *C.R. Acad. Sci., Paris*, **225**, 922–3 (*Nov.* 17, 1947) *In French.*—Gauge-invariance of the meson equations of Salvetti, in 5-dimensional form [Abstr. 1722 (1947)], is discussed when an electromagnetic field is present. G. J. K.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.111 : 517.12 = 4 1440

Durations and instants. WALKER, A. G. *Rev. Sci., Paris*, **85**, 131–4 (*Feb.* 1, 1947) *In French.*—In logical analysis of temporal experience, it is suggested that durations and not instants should be regarded as fundamental. Instants are defined in terms of durations which form a partially ordered class. It is shown that instants are simply ordered. R. A. N.

531.18 : 530.12 = 4 *see Abstr.* 1421

531.19 : 539.374 *see Abstr.* 1680

531.19 : 669.018 : 548.7 = 4 *see Abstr.* 1702

531.225 1441

Semi-rigid representation of elastic cantilevers for torsion problems in aerodynamics. COLLAR, A. R. *Phil. Mag.*, **39**, 97–104 (*Feb.*, 1948).—A simple example of the representation is given, the approx. and true solutions being noted. Conditions are found in order that the approx. method may yield true values for the critical dynamic head. L. S. G.

531.51 : 530.12 = 3 *see Abstr.* 1422

MECHANICAL MEASUREMENTS 531.7

531.717 : 539.215.4 1442

Particle-size measurement. MILLS, G. L. *Nature, Lond.*, **161**, 313–14 (*Feb.* 28, 1948).—A simple hydrometric method for measuring the mean diameter of the particles of a powder is described.

531.717.1.082.4 : 534.321.9 : 621.317.39 1443

Portable ultrasonic thickness gage. BRANSON, N. G. *Electronics*, **21**, 88–91 (*Jan.*, 1948).—An instrument primarily for use with full or empty pipes or tanks. A variable-frequency oscillator drives an X-cut crystal which is applied to the surface of the object being measured. As the oscillator is tuned through a frequency whose wavelength in the material = the thickness or a submultiple thereof, the extra loading causes an increase in anode current which can be indicated on a meter or detected aurally by applying a small amount of f.m. at a.f. to the oscillator. The frequency range is 1·4–2·8 Mc/s, the thickness range 0·125–12 in; the measurement accuracies for uniform and non-uniform thicknesses are better than 1% and 2–5% respectively. The instrument is battery operated and weighs <10 lb. H. G. M. S.

531.787.9 : 534.113 : 621.317.39 1444

A critical study of the Hopkinson pressure bar. DAVIES, R. M. *Philos. Trans. A* (*No.* 821) 375–457 (*Jan.* 8, 1948).—An electrical method for measuring the pressure/time relation in experiments on high pressures of short duration is described. The pressure is applied to one end of a steel bar, producing a stress pulse which causes radial and longitudinal displacements in the bar. These produce a change in the capacitance of a condenser unit charged to a high potential and connected via an amplifier to a double-beam c.r.o. An exact theory of the propagation of stress waves and pulses in a bar is presented. This explains certain of the experimental results, and is useful in discussing errors. Bars about 2 ft long and 0·5–1 in dia. may be used to measure pressures lasting for 10–20 μsec with an accuracy of 2–3%. L. S. G.

531.788.13 = 3 1445

An absolute manometer for measuring the smallest gas-pressures. KLUMB, H., AND SCHWARZ, H. *Z. Phys.*, **122** (*Nos* 5–8) 418–36 (1944) *In German.*—An absolute manometer on the radiometer principle for measuring pressures from 10^{-2} to 10^{-8} torr. is described. Electromagnetic damping is employed and the various ranges are obtained by using a counter-torque from the magnetic field of an electromagnet. The instrument is compared with ionization and hot-wire manometers and other instruments, and calibrated by means of a McLeod gauge. The scale is linear at low pressures and can be extrapolated for very low pressures beyond the range of other standard instruments. Test results with air, N_2, A and H_2 gases are given. V. W. R.

531.788.7 = 3 1446

Gas clean-up and composition change when measuring very low pressures by the ionization-manometer. A critical investigation with H_2, N_2 and A. SCHWARZ, H. *Z. Phys.*, **122** (*Nos* 5–8) 437–50 (1944) *In German.*—Ionization manometers depend on the variation of ion current with gas pressure in a thermionic valve-type structure. Tests on the instrument with low-pressure H_2, N_2 and A gases show that its readings are not reliable. This is due to the presence of heated metal parts in the vacuum to be measured, which cause gas clean-up by absorption, or change in the gas composition under test due to liberation of occluded gases. The use of ionization manometers for pressures $<10^{-4}$ torr. is therefore deprecated. V. W. R.

531.788.7 : 621.395.645 = 82 1447

Ionization manometer with d.c. amplifier. KRUSSER, B. V. *J. Tech. Phys., USSR*, **17** (*No.* 1) 63–70 (1947) *In Russian.*—A triode manometer ("grid" positive, "anode" negative) and 2 types of amplifier are described. A. L.

MECHANICS OF LIQUIDS 532

532.516 144

The generalised equations of Reynolds. SLEZKIN, N. A AND TARG, S. M. *C.R. Acad. Sci. URSS*, **54** (*No.* 3 205–8 (1946).—The equations describe the motion of viscous fluid and are intermediate between those c Reynolds, occurring in the approx. theory of lubricatio and those of Prandtl, in which quadratic inertia term are present. They are obtained from Prandtl's equation by averaging over the thickness of the layer of viscou fluid. A formula for the pressure distribution is obtaine L. S. C

532.516 = 4 144

Generalization of the formulae of Helmholtz and Cauch for a viscous incompressible fluid. CÂRSTOIU, I. *C.I Acad. Sci., Paris*, **223**, 1095–6 (*Dec.* 23, 1946) *In French.*— The equations are extended to cover the case wher vortices arise. They show how Lagrange's theorem cease to be valid for the fluid considered. L. S. C

532.516 = 4 145

On the decrease of the kinetic energy of a viscous incon pressible fluid occupying a bounded flat domain. DE FÉRIE J. K. *C.R. Acad. Sci., Paris*, **223**, 1096–8 (*Dec.* 23, 194 *In French.*—It is shown that the kinetic energy, $E(t$ at a given time t, is of the form $E(t) = E_0\varepsilon^{-\alpha t}$, and th constant α is evaluated. L. S. C

532.516 : 541.183 *see Abstr.* 1689

532.517 = 4 145

Movement of a viscous fluid between concentric spheres CHARRON, F. *C.R. Acad. Sci., Paris*, **223**, 1098– (*Dec.* 23, 1946) *In French.*—An experimental study made of the motion of the fluid when the inner sphe (of steel) rotates with respect to the outer sphere (of glass The torque is measured and the movement of the strea lines is followed by injecting a coloured thread of liqui and observing with a microscope. L. S. C

532.517.2 145

On the problem of refining the solutions of Reynold equations. SLEZKIN, N. A. *C.R. Acad. Sci. URSS*, 5 (*No.* 2) 121–3 (1946).—Plane steady motion in a layer a viscous incompressible fluid is considered. The exa equations of motion are written down, and from these th equations of Reynolds and of Prandtl may be deduce The solutions may be written in the form of series, bu from the third approx. onwards both variation of pressu along the thickness of the layer and the viscosity term must be considered. L. S. C

532.517.2 = 3 145

General representation of velocity distribution. MAGYA F. *Z. Phys.*, **122** (*Nos* 9–12) 640–7 (1944) *In German.*— Deals with the velocity distribution of fluid flow in pipe The velocity distributions according to v. Kármán an others do not yield continuous functions showing th transition of flow near the middle of the pipe to th laminar flow close to the walls. The author develo an expression which gives the velocity distribution fro the centre to the walls as a continuous curve, and agre well with measurements. V. W. I

532.517.3 = 4 145

Note on the notion of long-distance order applied to th velocity distribution in liquids. WINTER, J. *C.R. Aca Sci., Paris*, **225**, 859–61 (*Nov.* 10, 1947) *In French.*— The author proposes to extend the notion of lon distance order as established in the theory of supe lattices to the velocity distribution in liquids where th transition from laminar to turbulent flow correspon to the order-disorder transition. The suggested trea

t should consist in a consideration of the interaction djacent filaments of liquid on a wave-mechanical s. The movement of a filament would be represented certain eigenfunctions which are perturbed by the r filaments. From the properties of the Mathieu tions, which would appear in a periodical per- ation field, disturbance of the long-distance order at ditions similar to the well-known turbulence con- ons is foreseen. H. L.

517.4 : 533.15.096 = 3 *see Abstr.* 1463

517.4 : 533.6.01 = 3 *see Abstr.* 1466

52 : 535.551 : 532.74 = 393 *see Abstr.* 1460

525 = 4 1455

pplication of relative motion about the centre of gravity a formula concerning global discharge in a tuyère. SON, T. *C.R. Acad. Sci., Paris*, **225**, 796–8 (*Nov.* 3, 7) *In French.*—Application of the principle of the servation of energy to the relative motion of a fluid ticle about a point coinciding at time t with the c.g. the particle is shown to lead to a general deduction fluid discharge in a tuyère. A particular case of the eral result now deduced is given by Stodola. J. S. G. T.

CAPILLARITY 532.6

KINETIC THEORY OF LIQUIDS 532.7

.7 : 548.73 = 3 1456

he atomic distribution in the liquid elements Pb, Tl, In, , Sn, Ga, Bi, Ge, and in liquid alloys of the system -Sn. HENDUS, H. *Z. Naturforsch*, **2a**, 505–21 (*Sept.*, 7) *In German.*—X-ray diffraction photographs are en of the various liquid elements concerned and the ensity curves obtained photometrically subjected to urier analysis. The co-ordination number in the melt found to be < that in the crystal in every case. In uid compounds of the Au–Sn system both "ordered" d "disordered" arrangements are found. In the lectic, however, only "disorder" occurs. J. T.

2.72 1457

A diffusion problem in which the amount of diffusing bstance is finite. II. Diffusion with non-linear adsorption. ANK, J. *Phil. Mag.*, **39**, 140–9 (*Feb.*, 1948).—A con- uation of previous work [Abstr. 849 (1948)]. A thod of evaluating approx. numerical solutions of the ffusion equations is described for the case where the te of deposition is rapid compared with diffusion, but e relation between the concentrations of deposited and ffusing dye is non-linear. L. S. G.

2.72 = 4 1458

On the Soret effect in aqueous solutions of cane sugar. N DRANEN, J., AND BERGSMA, F. *Physica*, *'s Grav.*, , 558–60 (*Nov.*, 1947) *In French.*—Using the thermo- avitational method, values of the Soret coefficient rying between $0{\cdot}55 \pm 0{\cdot}05$ and $0{\cdot}85 \pm 0{\cdot}05$ are und for concentrations varying between 4·97% to ·43% weight at 30°C. These figures are < those tained by Wereide and by Tanner who used the static ethod. H. L.

2.72.08 : 535.417 1459

Experimental tests of an interference method for the udy of diffusion. LONGSWORTH, L. G. *J. Amer. Chem. c.*, **69**, 2510–16 (*Oct.*, 1947).—Experimental con- mation of the theory of Kegeles and Gosting [Abstr. 3 (1948)] has been obtained by measuring the inter- rence fringes photographed after diffusion (Lamm cell, $a = 1\,600$ cm) of 0·6 N KCl into 0·4 N KCl for 7 500 sec at 0·5°. A method of using these fringes in evaluating diffusion coefficients is suggested. Difficulties encountered when the Lamm cell was used with proteins, or the Tiselius electrophoresis cell as a diffusion cell for salts or proteins, are discussed. W. R. A.

532.74 : 532.52 : 535.551 = 393 1460

The contribution of macromolecules in a flowing liquid. KRAMERS, H. A. *Physica*, *'s Grav.*, **11**, 1–19 (*Jan.*, 1944) *In German.*—The statistical behaviour of the individual links of the dissolved molecules is investigated. Results equivalent with those of Hermans are derived [Abstr. 2500 (1946)]. The method can also be applied to molecules possessing branching points and rings. A.

MECHANICS OF GASES 533

533.15.096 = 3 1461

Change of sign of the diffusion thermo-effect. WALDMANN, L. *Z. Naturforsch.*, **2a**, 358 (*June*, 1947) *In German.*—Determination of the diffusion thermo-effect of N_2/A; O_2/A; N_2/O_2 by the stationary method [Abstr. 2802 (1946)] at 89°K and for the latter two mixtures also at 293°K. For N_2/A and O_2/A the sign of the effect is opposite to that at room temperature, which means that in a thermal diffusion experiment carried out at low temperatures the A will move towards the hotter wall. With N_2/O_2 at 89°K no effect could be detected. From this follows a thermal diffusion coefficient $|\alpha| < 0{\cdot}001$. H. L.

533.15.096 = 3 1462

The separation tube at high pressure with a radial electric field. I. Effects of the field which are independent of turbulence. BECKER, E. W. *Z. Naturforsch.*, **2a**, 441–6 (*Aug.*, 1947) *In German.*—The experiments were carried out in concentric Clusius–Dickel tubes at a pressure of 16 atmos. and with potential differences across the tube up to 55 kV. The mixture used in most experiments was CO_2–N_2. In an unheated tube set up with a longitudinal concentration gradient, an electric field considerably increases the mixing speed of the components. This is due to the convection currents produced by an inhomogeneous electric field in a fluid of inhomogeneous permittivity. Another effect of the field, which does not require a concentration gradient, is observed when the inner tube is heated. Here the field interferes with the thermal convection in such a way that the mixing is reduced. This effect seems to be confined to small regions at the ends of the tube and near a number of spacers which are arranged at intervals along the tube. It is probably due to cross-currents which can be expected if the hot portion of the gas which has a reduced permittivity is in the region of highest field strength. The effect is not observed when the outer wall is heated. H. L.

533.15.096 : 532.517.4 = 3 1463

The separation tube at high pressure with a radial electric field. II. Turbulence effects. BECKER, E. W. *Z. Naturforsch.*, **2a**, 447–54 (*Aug.*, 1947) *In German.*—The experiments [Abstr. 1462 (1948)] are extended to higher temperature differences and pressure; this leads into the region of turbulence. In the absence of the field the effect of turbulence is roughly equivalent to a diminution of the wall distance, i.e. to an increase in separation per unit length, a decrease in the transport of the components and a decrease in temperature gradient for a given heater power. It is, however, remarkable that the power efficiency remains constant, which means an increase of entropy efficiency with turbulence. An electric field applied at constant pressure and heater power in an

arrangement where the outer tube is heated strongly increases the thermal convection currents. The separation is decreased and the temperature difference is increased to a much lesser degree. This results in a 3·5× increase in power efficiency, and even in a considerable increase in entropy efficiency at 50 kW. If the inner wall is heated, the convection currents and efficiencies and even the separation are decreased. These effects cannot be fully explained by the effect of the field on turbulence. H. L.

533.15.096 : 539.155.2 1464

The thermal diffusion constant of nitrogen. MANN, A. K. *Phys. Rev.*, **73**, 412–13 (*Feb.* 15, 1948).—Results for two-bulb thermal diffusion experiments are given for Ne, A, and N and compared with those of Nier [Abstr. 31 (1940), *Phys. Rev.*, **57**, 338 (1940)] and Stier [Abstr. 820 (1943)]. W. E. D.

533.275 : 539.217.3 : 621.317.39 1465

Application of the electric hygrometer to the determination of water vapour permeability at low temperature. VAN DEN AKKER, J. A. *Paper Tr. J.*, **126**, *TAPPI Sect.*, 6–11 (*Jan.* 1, 1948).—A simple electric hygrometer, having a very small water absorption capacity, is described. It consists of 2 thin evaporated Pt films on a glass plate, separated by a very fine gap filled with partly hydrolysed polyvinyl acetate containing a small proportion of LiCl. The Pt films are connected, by means of "finger" contacts, in series with a galvanometer and resistance, and the current passed by the hygrometer for a particular applied voltage is measured. The hygrometer must be calibrated in terms of galvanometer readings, under conditions of standard relative humidity. Sources of error, and their elimination, are discussed. J. G.

533.6.01 : 532.517.4 = 3 1466

The symmetry of the potential tensor in aerodynamics. KRIESIS, P. *Z. Phys.*, **122** (*Nos* 9–12) 778–86 (1944) *In German.*—Deals with the aerodynamic theory of turbulence. According to viscous fluid theory, infinite potentials should occur when the velocity distribution is unstable. Using the kinetic gas theory the author finds that these potentials are finite, but are transient and unstable as well as unsymmetrical, and that the potential tensor is probably unsymmetrical. V. W. R.

533.6.011 1467

Extension of Crocco's theorems to flows having non-uniform stagnation enthalpy. PRIM, R. C. *Phys. Rev.*, **73**, 186 (*Jan.* 15, 1948).

533.6.011.5 : 535.436 *see Abstr.* 1527

533.6.011.6 : 536.25 = 4 *see Abstr.* 1535

533.6.013.22 : 533.6.08 *see Abstr.* 1468

533.6.08 : 533.6.013.22 1468

Constant temperature operation of the hot wire anemometer at high frequencies. OSSOFSKY, E. *Phys. Rev.*, **73**, 410 (*Feb.* 15, 1948).—Some of the difficulties, which are encountered in applying the const. temp. hot-wire anemometer to turbulence measurements, are discussed. W. E. D.

KINETIC THEORY OF GASES 533.7

VIBRATIONS . ACOUSTICS 534

534.01 : 621.3.01 = 5 1469

Contribution to the study of electrical-mechanical analogies. NUOVO, M. *Mem. Accad. Naz. Lincei*, **1**, 26–50 (1946) *Pubbl. Ist. Naz. Elettroacust. O.M. Corbi* (*No.* 66) *In Italian.*—The author develops a gene method of deducing the mechanical system equivalent an electrical circuit, or vice versa, when the system defined (*a*) by a set of differential equations, or (*b*) by t mechanical (or electrical) system itself. The meth consists of a synthesis of the characteristic matrix impedance and admittance, which can be decompos into the sum of three matrices, viz. a resistance matrix, impedance matrix and an "elastic" matrix, for a 2 terminal network. Some examples are given V. C. A.

534.113 = 3 14

Axial longitudinal oscillations of a straight rod crystalline material. BECHMANN, R., AND PETRŽÍLKA, *Z. Phys.*, **122** (*Nos* 9–12) 589–99 (1944) *In German.* The elastic theory by R. Bechmann [*Z. Phys.*, **117**, 1 (1941)] is applied to explain the deviation of the directi of propagation from the direction of movement in th crystalline rods when subjected to axial longitudin oscillations. The direction of movement is found depend on the normal of the polarization plane produc by a radius vector pointing in the direction of propag tion. The plane of movement for travelling waves, ar the nodal plane for standing waves, is parallel to a pla tangential to the polarization plane. Experiments narrow quartz rods corroborate the theory. V. W.

534.113 : 531.787.9 *see Abstr.* 1444

534.13 : 534.37 = 3 14

Theory of thermal damping in solid matter. PÄSLER, *Z. Phys.*, **122** (*Nos* 5–8) 357–86 (1944) *In German.* "Thermal damping" is the damping of mechanic oscillations by internal friction. The equation of motio is derived, using Hamilton's principle, but the therm energy due to deformation is included in the expressio for the elastic potential energy of the oscillating syste The equation of motion has an additional term represen ing "thermal damping"; and the logarithmic decreme is defined as measure of "thermal damping." Th general theory is developed and applied to calcula "thermal damping" for rods, plates, spheres an cylinders subjected to oscillations. V. W.

534.133 = 3 14

Elastic natural oscillation of a right-angled quart parallelepiped. BECHMANN, R. *Z. Phys.*, **122** (*Nos* 5–8 510–26 (1944) *In German.*—The natural oscillations of right-angled quartz parallelepiped are mathematicall investigated. The theory is then applied to an infinitel thin plate with finite sides, an infinite slab of finit thickness, an infinitely thin rod and a cube. Experiment were made to test the theory by piezo-electric method Theory and experiment agree in the case of longitudina oscillations. To achieve agreement with transvers oscillations, an empirical correction is added. Theor and experiment do not correspond in the case of cube The relation between the overall deformation with given mode of oscillation and the component deforma tions is investigated. V. W.

534.21 : 534.321.9 = 3 14

On the propagation of sound waves in fluids. SEIDL, *Acta Phys. Austriaca*, **1** (*No.* 2) 155–66 (1947) *In German.*—Photographs of ultrasonic waves are repro duced, obtained by the Töpler–Schlieren method com bined with the use of the Debye–Sears effect. Th generating quartz was of frequency 3 Mc/s, and th density of the liquid medium used varied with depth The photographs show wave systems formed b diffraction, and by reflection at plane and curve surfaces. Effects obtained by varying the position of th

erating quartz when partially or completely immersed e also studied. In certain wave-systems, observations sound intensity were taken by means of a quartz be to supplement the photographic records. [See Abstr. 5404 (1937)]. G. G.

.222 : 551.596.1 *see Abstr.* 1722

.222.2 = 4 1474

he physics of shock waves. HERPIN, A. *Rev. Sci., is,* **85,** 817–26 (*Aug.* 1, 1947) *In French.*—An interesting orical survey is given of outstanding results, theoretical experimental, which throw light upon the conditions pressure, density, temperature, velocity, in a fluid which ransmitting a shock wave. The most important ance in the theory is attributed to Hugoniot, and his hod is discussed in some detail, to indicate definite lts obtainable by calculation as well as more general lts which can be deduced therefrom. The high peratures attained within a shock wave, indicated by ory, are confirmed by the results of experiments cribed and illustrated with photographic records of inous shock waves. G. G.

.222.2 : 541.126 *see Abstr.* 1687

.232 = 3 1475

he sonic field of a radiator in a layer of medium with ustically "soft," or acoustically "hard" boundary. NZEL, H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 1–2) 1–31 43) *In German.*—The general formulae for the radia- n and reflection and the sonic field of an acoustic iator when placed in a layer of medium (e.g. water) anded by two absorptive or reflective planes is deduced. e sonic field in the vicinity of the radiator source is culated for large and small thickness of the medium er. The reflected and radiated power in a medium h an upper absorptive boundary and a lower reflective undary is studied. Numerical examples are included. V. W. R.

.24 : 534.833.1 = 4 *see Abstr.* 1478–9

.321.9 : 534.21 = 3 *see Abstr.* 1473

.321.9 : 534.845 = 4 1476

Absorption of supersonic waves in mixtures of methyl ohol — water and ethyl alcohol — water. MIKHAILOV, G., AND GOUREVITCH, S. B. *C.R. Acad. Sci. SS,* **52** (*No.* 8) 673–4 (1946) *In French.*—The ab- ption was measured for sound waves of frequency 97 Mc/s, and for various concentrations of the xtures. The temperature was 18°C. The results are own graphically by plotting α/ν^2 against the con- ntration (α = coefficient of absorption, ν = fre- ency). A maximum occurs at ~80% concentration methyl alcohol–water and at ~60% for ethyl ohol–water. L. S. G.

.321.9 : 621.317.39 : 531.717.1.082.4 *see Abstr.* 1443

.37 : 534.13 = 3 *see Abstr.* 1471

.511.2 : 535.33 *see Abstr.* 1485

.75 : 612.85 1477

An auditory afterimage? ROSENBLITH, W. A., MILLER, A., EGAN, J. P., HIRSH, I. J., AND THOMAS, G. J. *ence,* **106,** 333–5 (*Oct.* 10, 1947).—The subject under t wears a pair of earphones excited by a train of tangular voltage pulses. These pulses are suddenly off and followed immediately by recordings of niliar sounds such as handclaps, typewriters, scraping ndpaper, etc. These at first have a peculiar metallic ality ("twangy"), but as the after-effect of the pulses s out (in a few seconds) they regain their normal quality. Experiments have been made varying the pulse duration (~100 μsec), peak pressure of pulse (for 75 to 125 db above 0·0002 dyne/cm²) and the time interval between the pulses. It is concluded that the observed after-effect of the pulses is not a tinnitus (ringing in the ears), a simple hearing loss, or a pathological condition; it is considered to be a positive after-effect of the stimulation of normal listeners. A. B. W.

534.8 : 616–001 *see Abstr.* 1724

534.833.1 : 534.24 = 4 1478

Study of a resonance method for measuring the transmission of acoustic vibrations through a partition and their reflection. LIÉNARD, P. *C.R. Acad. Sci., Paris,* **223,** 889–91 (*Nov.* 27, 1946) *In French.*—An experimental method for measuring the reflection and transmission coefficients is described and the theory is given. From measurements made on 115 samples of very different materials for the partition, it is evident that the acoustic properties of a material are functions not only of its physical properties but of external conditions, e.g. mode of support in the case of the partition. The experiments were carried out with sound of a frequency 250 c/s. L. S. G.

534.833.1 : 534.24 = 4 1479

Variation of the acoustic properties of materials with the mode of use. LIÉNARD, P. *C.R. Acad. Sci., Paris,* **223,** 1107–10 (*Dec.* 23, 1946) *In French.*—A continuation of previous work [Abstr. 1478 (1948)]. The vibration of a partition depends on such factors as the porosity, density and elasticity of the material composing the partition, and on the impedance of the space behind the partition, etc. These are discussed, and experimental results are given showing how widely the transmission and reflection coefficients of a given partition may vary under different conditions. L. S. G.

534.834 1480

Attenuation of sound in lined air ducts. BRITTAIN, C. P., MAGUIRE, C. R., SCOTT, R. A., AND KING, A. J. *Engineering,* **165,** 97–8 (*Jan.* 30); 145–7 (*Feb.* 13, 1948).—An experimental study (100–10 000 c/s) is described. The attenuation is measured with reference to the material lining the duct. The curves of attenuation *v.* frequency for ducts with linings of porous material show low attenuation at l.f. and h.f. with a fairly pronounced peak at m.f. The impedance is determined at low frequencies by the reactance of the air in the porous material. This reactance, which is negative in sign, can be reduced by combining with it the positive reactance of a cover sheet of appreciable mass and negligible thickness. Useful attenuation might be expected at selected frequencies in a duct lined with a succession of diaphragms each made resonant at a desired frequency by an enclosed volume of air behind it. At h.f., where the wavelength is < the width of the air duct, transverse waves are rapidly absorbed at the beginning of the duct and the sound propagated along the duct consists mainly of a beam of axial waves. This beam tends to keep to the middle of the duct and is affected little by the absorbent walls. The effects of bends in duct are also studied. A. B. W.

534.845 : 534.321.9 = 4 *see Abstr.* 1476

OPTICS . RADIATION . SPECTRA 535

535.1 : 530.145 : 539.18 = 3 *see Abstr.* 1660

535.215 : 537.312.5 = 3 *see Abstr.* 1551

535.215 : 537.542 *see Abstr.* 1584

535.215 : 621.383.2 : 537.312.5 *see Abstr.* 1552

535.232 : 778.3 = 3 1481

Theory of intensity distribution. (Proposed standardization of continuous spectra photographs). WILKENS, G. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 1–2) 73–90 (1943) *In German.*—The location of the intensity max. in a continuous spectrum photo depends on the method of projection. The theory of projection with equal film distances representing equal (*a*) frequency differences, (*b*) wavelength differences, (*c*) frequency/wavelength quotients is given. The location of the intensity max. in the 3 methods is determined using Planck's law; (*c*) gives the same intensity distribution whether working with frequency or wavelength and is proposed as a standard known as "logarithmic projection." Two practical forms of spectrographs for logarithmic projections are discussed and the salient features of all three projections tabulated. V. W. R.

535.235 : 535.241.32 = 3 1482

The spectral energy distribution of the Hefner-lamp. KUNZE, P. *Z. Phys.*, **122** (*Nos* 5–8) 494–6 (1944) *In German.*—The Hefner-lamp standard may be used as a spectrum standard of known intensity for comparison purposes. The paper gives an improved equation for the spectral energy distribution in cal/sec per cm² surface at 1 in distance; $E_\lambda = 0{\cdot}0268\,\lambda^{-6{\cdot}4}\varepsilon^{-\frac{14\,300}{\lambda\cdot 1675}}$, where λ is wavelength in microns. This is in better accordance with experimental results [Valentiner and Rössiger, *Ann. Phys., Lpz.*, **76**, 785 (1925); Ångström, *Phys. Z.*, **5**, 456 (1904)]. V. W. R.

535.24 : 541.23 : 539.155.2 = 3 *see Abstr.* 1624

535.241.32 : 535.235 = 3 *see Abstr.* 1482

535.247.3 : 522.615 *see Abstr.* 1389

535.31 : 537.531 = 3 *see Abstr.* 1574

535.317.1 : 771.534.553 *see Abstr.* 1729

535.32 = 4 1483

Precision refractometry. Refraction and dispersion of water. DUCLAUX, J., AND BRICOUT, V. *J. Phys. Radium* (*Sér.* 8) **8**, 185–8 (*June*, 1947) *In French.*—Refinements of the liquid prism method are described, using which it is claimed that relative refractive indices correct to the sixth decimal place are obtainable. A study is made of the variation of the refractive index of water with temperature between 8°C and 25°C. Determinations of the dispersion are also made. A. H.

535.321 1484

A short-focus modification of the Lamm scale method for measuring refractive index gradients. SVENSSON, H. *Nature, Lond.*, **161**, 234 (*Feb.* 14, 1948).

535.33 : 534.511.2 1485

Fast modulation effects in the optical region. RUARK, A. *Phys. Rev.*, **73**, 181 (*Jan.* 15, 1948).—[See Abstr. 569 (1948)]. Attention is drawn to an earlier paper [Abstr. 2716 (1927)]. An experiment for production of very short light pulses by a rotating mirror is described which was set up in 1926 but not completed. W. E. D.

535.33–15 : 621.383.4 : 537.312.5 *see Abstr.* 1553

535.33.072 : 535.421 *see Abstr.* 1521

535.338 : 537.527.5 = 3 1486

The continuous spectrum of the high-pressure Hg-discharge. RÖSSLER, F. *Z. Phys.*, **122** (*Nos* 5–8) 285–313 (1944) *In German.*—The line and continuous spectrum of high pressure Hg-arc lamps are proved to be similar. A method of determining the excitation voltage of known standard lines and deducing that of the unknown lines is given. Special filters and photocells are used for infrared and ultraviolet wavelengths. The excitation value of 8·6 V for a continuous spectrum was foun constant for a wide range of pressures, lamp types, an with operation on d.c. and a.c. The effect of lam pressure, rating, etc., on spectral energy distribution i discussed. The emission of a continuous spectrum i Hg-lamps is thought to be due to molecular collision or uncharged particles and the theory is explained i detail. V. W. F.

535.338.1 : 535.343.1 148

Investigation of the band-spectrum of aluminiu hydride [λλ1700–2500Å.] NILSSON, B. E. *Ark. Ma Astr. Fys.*, **35A** (*Paper* 19) 10 *pp.* (1948).—The 0,0 ban of the transition $^1\Pi^* \rightleftharpoons {}^1\Sigma$ has been observed. I forms a red-degraded *R*-head at 1 887·4 Å, and *Q*-line have been measured from $J = 1$ to 15. Rotationa analyses of the $^1\Sigma^* \rightleftharpoons {}^1\Sigma(\lambda 2229)$ and $^1\Sigma^{**} \rightleftharpoons {}^1\Sigma(\lambda 2033$ systems have been extended. Figures are given for line of the 0,0, 1,1 and 1,2 bands of the 2 229 system: cor responding perturbations are observed in the 1,1 an 1,2 bands. The 2 033 band has also been studied bot in emission, when the series breaks off at $J = 10$ due t predissociation, and in absorption, when the lines can b followed to $J \sim 30$. R. F. B

535.338.332 : 539.155.2 = 3 *see Abstr.* 1623

535.338.334 148

On the phase shift approximation in the theory o pressure broadening of spectral lines. JABLOŃSKI, A *Phys. Rev.*, **73**, 258–9 (*Feb.* 1, 1948). **The theory of th pressure broadening of spectral lines: a reply.** FOLEY H. M. *Phys. Rev.*, **73**, 259 (*Feb.* 1, 1948).—A criticism of a paper by Foley [Abstr. 2554 (1946)] and a reply. W. E. D

535.338.4 148

New bands in the second negative or ultraviolet ban system of O_2^+ molecule ($^2\pi_g \rightarrow {}^2\pi_g$). LAL, L. *Phys Rev.*, **73**, 255 (*Feb.* 1, 1948).—New bands have bee discovered in this spectrum, and quantum transitions hav been assigned to them. W. E. D

535.338.4 149

Band spectrum of aluminium bromide. JENNERGREN C. G. *Nature, Lond.*, **161**, 315 (*Feb.* 28, 1948).

535.338.4 = 4 1491

Excitation of the spectrum of nitrogen by passing ar electric discharge through ammonia. JANIN, J., AND CROZET, A. *C.R. Acad. Sci., Paris*, **223**, 1114–16 (*Dec.* 23, 1946) *In French.*—The spectrum was studied in the ultraviolet region. It was found to consist of (*a*) a continuous spectrum, due probably to molecular hydrogen, (*b*) certain bands of NH, and (*c*) different systems of bands of nitrogen. Results of measurements of the wavelengths of the edges of the bands are given. [See Abstr. 1817 (1947)]. L. S. G.

535.338.4 : 535.37 : 537.52 = 4 1492

Variation with temperature of the spectrum of the nitrogen afterglow. HERMAN, L., AND HERMAN, R. *C.R. Acad. Sci., Paris*, **225**, 1137–9 (*Dec.* 10, 1947) *In French.*—In addition to the yellow afterglow of long duration, nitrogen possesses a complex afterglow of short duration. The effect of cooling and of pressure on the spectrum of the latter is studied; relative strengths of the First Positive, First Negative, Goldstein and χ bands are compared. The cause of the afterglow is discussed; ^2D atoms are involved, and Mitra's theory is inadequate. A. G. G.

535.338.4 : 536.46 1493

Band spectrum of ClO in flames. PANNETIER, G., AND GAYDON, A. G. *Nature, Lond.*, **161**, 242–3 (*Feb.* 14, 1948).

5.338.4 : 536.46 = 4 1494

The emission spectrum of a flame of methyl chloride ed with oxygen burning in air. PANNETIER, G., AND YDON, A. G. *C.R. Acad. Sci., Paris*, **225**, 1139–40 ec. 10, 1947) *In French.*—Bands of CCl, ClO, C_2, I and OH are observed. Also a continuum due to ombination of Cl atoms. A. G. G.

5.338.4 : 551.510.4 1495

Production of nitrogen atoms in the upper atmosphere. RZBERG, G., AND HERZBERG, L. *Nature, Lond.*, **161**, 3 (*Feb.* 21, 1948).—Predissociation of N_2 has been served in a h.f. low-pressure discharge, and the nificance is discussed.

5.343–15 : 539.132 = 4 1496

Study by infra-red spectrography of the characteristic ration frequency of ketones in ortho-substituted lohexanones. CHERRIER, C. *C.R. Acad. Sci., Paris*, 1063–5 (*Dec.* 1, 1947) *In French.*

5.343.1 : 535.338.1 *see Abstr.* 1487

5.343.2 = 3 1497

Absorption spectra of some hydrated erbium salts. VERIN, H. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 41–58 47) *In German.*—The absorption spectra of $Er(NO_3)_3$ $_2O$, $Er_2(SO_4)_3\ 8H_2O$, and $Er(EtSO_4)_3\ 9H_2O$ have been mined and, in agreement with observations on spectra of Nd and Pr salts, the lines of Er salts fall three different groups. Crystal field splitting, mean breadth, and intensity of lattice vibrations have been ermined and are discussed. The scattering character been estimated from the polarization state of the sorption lines in $Er(EtSO_4)_3$. W. R. A.

5.343.3–15 : 539.132 = 4 1498

Study by infra-red spectrography of the characteristic ration frequency of ketones in ortho-substituted lopentanones and in aliphatic ketones. CHERRIER, C. *R. Acad. Sci., Paris*, **225**, 997–9 (*Nov.* 24, 1947) *In nch.*

5.343.3–31 1499

The ultra-violet absorption spectra of simple unsaturated npounds. I. Mono- and *p*-disubstituted benzene ivatives. DOUB, L., AND VANDENBELT, J. M. *J. Amer. em. Soc.*, **69**, 2714–23 (*Nov.*, 1947).—At least three nds (secondary, first primary and second primary in ter of decreasing λ) in the absorption spectra of nzene and its mono- and *p*-disubstituted derivatives ow regular progressive modification which depends on nature of the substituent groups. The displacing ect of a substituent group on the primary band of nzene seems to be associated with a directional dis-cement of electrons to and from the aromatic nucleus l with mesomeric or resonance rather than with simple lombic displacements. A semi-empirical quantitative ationship has been proposed to explain the interaction substituent groups in the displacement of the first mary band. W. R. A.

5.343.4–14 1500

Saturation and power broadening of microwave resonance es. RICHARDS, P. I., AND SNYDER, H. S. *Phys. Rev.*, , 269 (*Feb.* 1, 1948).—An expression extending the ults of Van Vleck and Weisskopf [Abstr. 748 (1946)] given. W. E. D.

5.343.4–14 = 4 1501

Spectroscopy in the Hertzian domain. SOUTIF, M. *v. Sci., Paris*, **85**, 921–8 (*Sept.* 1 *and* 15, 1947) *In nch.*—A short illustrated review of recent work. bliography of 29 references.

5.343.4–14 : 537.228.5 : 539.133 1502

Stark spectrum of H_2O. GOLDEN, S., WENTINK, T., JR., HILLGER, R., AND STRANDBERG, M. W. P. *Phys. Rev.*, **73**, 92–3 (*Jan.* 1, 1948).—It has been possible to resolve 4 of the 6 components of the Stark spectrum of the rotation line of H_2O at 22 235·22 ± 0·05 Mc/s. Results are in reasonable agreement with theory and possible sources of errors are discussed. The dipole moment deduced from the results is 1·94 ± 0·06 Debye units. W. E. D.

535.343.4–14 : 537.228.5 : 539.133 1503

Stark spectrum of HDO. STRANDBERG, M. W. P., WENTINK, T., JR., HILLGER, R. E., WANNIER, G. H., AND DEUTSCH, M. L. *Phys. Rev.*, **73**, 188 (*Jan.* 15, 1948).—Measurements were made on 3 of the 5 detected Stark components of the 22 307 Mc/s rotation line. A theoretical formula is discussed and a value for the dipole moment is deduced. W. E. D.

535.343.4–14 : 539.152.2 1504

Nuclear quadrupole interaction in the ICl rotational spectrum. WEIDNER, R. T. *Phys. Rev.*, **73**, 254 (*Feb.* 1, 1948).

535.345 : 549.211 : 539.16.08 1505

Ultraviolet transmission of "counting" diamonds. FRIEDMAN, H., BIRKS, L. S., AND GAUVIN, H. P. *Phys. Rev.*, **73**, 186–7 (*Jan.* 15, 1948).—It is shown that counting diamonds belong to type II [see Abstr. 2291 (1934)], i.e. those which have a greater u.v. transparency. W. E. D.

535.36 : 537.531 : 548.736.442 = 4 *see Abstr.* 1711

535.37 1506

Luminescence of solid solutions of the system $CaMoO_4$–$PbMoO_4$ and of some other systems. KRÖGER, F. A. *Philips Res. Rep.*, **2**, 183–9 (*June*, 1947).—As shown in a previous paper [Abstr. 1505 (1948)], the fluorescence of solid solutions (Zn, Mg)WO_4 can be interpreted simply as the superposition of the fluorescence of its two components; but in the systems (Ca, Pb)WO_4, (Sr, Pb)WO_4 and (Ba, Pb)WO_4 new emission bands were observed which were attributed to tungstate groups with mixed surroundings of Pb and Ca, Sr or Ba ions. In this paper the systems (Ca, Sr)WO_4, (Ca, Sr)MoO_4, and (Ca, Mg)$_3WO_6$ are shown to behave as (Zn, Mg)WO_4, whereas (Ca, Pb)MoO_4 behaves as (Ca, Pb)WO_4. A.

535.37 : 537.52 : 535.338.4 = 4 *see Abstr.* 1492

535.37 : 548.0 1507

Photoluminescence in the quaternary system $MgWO_4$–$ZnWO_4$–$MgMoO_4$–$ZnMoO_4$. KRÖGER, F. A. *Philips Res. Rep.*, **2**, 177–82 (*June*, 1947).—Four different crystal structures appear in the system. The fluorescence and absorption of products of these structures are studied. A.

535.371 1508

Infra-red luminescence of cuprous oxide. LASHKAREV, V. E., AND KOSSONOGOVA, K. M. *C.R. Acad. Sci. URSS*, **54** (*No.* 2) 125–6 (1946).—The oxide exhibits an intense luminescence in the near infra-red under illumination by visible light, the region of wavelengths of the luminescent radiation being 0·9–1·0 μ. The luminescence yield was found to be have a lower limit of $\sim 5 \pm 2\%$, which gives an average quantum yield of $\sim 10\%$. The yield depends strongly on the temperature, and this was studied in the range 120°C to −45°C. The logarithm of the yield is plotted against (absolute temperature)$^{-1}$. L. S. G.

535.371 1509

On the interaction of Zn and Mn emission in ZnS . Mn-phosphors. Effect of wavelength of exciting light. I. LEWSCHIN, W. L. *C.R. Acad. Sci. URSS*, **54** (*No.* 2) 127–9 (1946).—ZnS . Mn phosphors with one activator have 2 luminescence bands: the band of the introduced activator (yellow in the case of Mn), and the blue band of the surplus Zn. The influence of the wavelength of

the exciting light upon the increase in intensities of these bands when the intensity of the exciting light is increased is studied, the excitation being by the Hg lines 366 and 312 mμ. When the excitation is increased, the blue band grows slowly at first and then rapidly; the yellow band tends to saturation. L. S. G.

535.371 : 539.165 1510

Excitation of infra-red phosphors by alpha- and beta-particles. THOMPSON, R. H., AND ELLICKSON, R. T. *Phys. Rev.*, **73**, 185–6 (*Jan.* 15, 1948).—Experimental evidence is put forward to show that when phosphors are made infra-red-sensitive by exposure to a radioactive radiation, it is mainly the β-particles which are responsible for producing this sensitive state. W. E. D.

535.372 1511

Phosphors sensitive to "red" light. ANTONOV-ROMANOVSKY, V. V., LEWSCHIN, W. L., MORGENSTERN, Z. L., AND TRAPEZNIKOVA, Z. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 1) 19–22 (1946).—Irradiation of excited phosphors by "red" light in some cases accelerates the expenditure of accumulated light energy and gives rise to a flash effect. Some properties of the new phosphors producing a bright flash are outlined. Phosphorescence and flash spectra of alkaline earth sulphides with 2 activators, Sm and Ce, or Sm and Eu, are practically the same, presenting broad diffuse bands. Phosphors with or without Sm show the same type of spectrum, but without Sm the phosphorescence is sharply increased and the flash is insignificant. Curves are drawn showing the relative energy output in the flash of different alkaline-earth phosphors with Sm and Ce, for varying wavelength of the light. These phosphors include CaS . SrS in the ratios 1 : 1 and 1 : 2. L. S. G.

535.375.5 = 3 1512

Variation of the CO-frequency in the Raman spectra of homologous series of compounds of the structure R . CO . X. KOHLRAUSCH, K. W. F. *Acta Phys. Austriaca*, **1** (*No.* 2) 113–19 (1947) *In German.*—The Raman frequency lying in the region 1 700 to 1 800 cm^{-1} and associated with the CO-group was measured for a large number of compounds of the general type R . CO . X. The compounds investigated form six series in which X is respectively CH_3, H, OC_2H_5, OCH_3, Cl and Br: in each series the alkyl group R is varied from CH_3 up to C_9H_{19}. In any such series the deviations of the CO-frequency from the mean for the series are small, but it is concluded that they exceed the estimated error ($\pm$ 0·55 cm^{-1}) in the average of repeated determinations on duplicate spectra by different observers. When the mean deviation for all six series is plotted as a function of the chain-length of the group R, an alternation (analogous to that in the melting points of the corresponding fatty acids) is apparent. L. A. W.

535.375.5 = 3 1513

Raman spectra of mixtures of PCl_3 and PBr_3. THEIMER, O. *Acta Phys. Austriaca*, **1** (*No.* 2) 188–97 (1947) *In German.*—Raman spectra of 10 different mixtures of PCl_3 and PBr_3 are photographed with a spectrograph of large dispersion. The observed frequency shifts are explained in terms of alteration of the pyramidal angle of the molecules due to dipole interaction. Four new lines are ascribed to the species PCl_2Br and $PClBr_2$. L. A. W.

535.375.5 : 539.11 : 548.7 = 4 *see Abstr.* 1703

535.375.5 : 539.13 = 3 1514

On the Raman spectra of zinc-, cadmium- and mercury-dimethyl, and also of mercury methyl halides. FEHER, F., KOLB, W., AND LEVERENZ, L. *Z. Naturforsch.*, **2a**, 454–7 (*Aug.*, 1947) *In German.*—The spectra are tabulated together with data previously published by other experimenters, and systematically discussed. An interpretation of the spectra is attempted; the frequency between 600 and 700 cm^{-1} appearing in all the spectra is allotted to a small C–H deformation oscillation. The spectra indicate a straight-line structure for the metal dialkyls. A

535.375.5 : 539.132 = 4 151

Study of Raman spectrography of the characteristic vibration frequency of ketones. CHERRIER, C. *C.R. Acad. Sci., Paris*, **225**, 930–2 (*Nov.* 17, 1947) *In French.*

535.375.5 : 548.7 = 4 151

Raman effect. Experimental study of several cubic crystals. COUTURE, L., AND MATHIEU, J.-P. *C.R. Acad. Sci., Paris*, **225**, 1140–2 (*Dec.* 1, 1947) *In French.*—[See Abstr. 1836, 3146 (1947)]. Results are given for crystals containing one or more complex ions; $K_2(SnCl_6)$, (Sr, Ba, Pb)$(NO_3)_2$, $NaClO_3$, $NaBrO_3$.

535.376 : 548.7 151

The new phenomenon of electrophotoluminescence and its possibilities for the investigation of crystal lattices. DESTRIAU, G. *Phil. Mag.*, **38**, 700–39 (*Oct.*, 1947).—A detailed study was made of (*a*) the provocation of luminescence in certain substances by varying electric fields of high intensity; (*b*) the momentary illumination produced electrically by the disactivation of long duration centres in phosphorescent sulphides, previously stimulated; (*c*) the electrical extinction of the phosphorescence and (*d*) the electrical acceleration of the extinguishing effect of infra-red. The threshold field strength, for visible luminescence, was determined for various mixtures of ZnO and ZnS. The sensitivity of pure ZnO can be improved by adding small quantities of Cu in the form of either $CuSO_4$ or $Cu(NO_3)_2$. The variation of the thresholds with temperature was determined, the threshold decreasing with increasing temperature. The effects of hysteresis and fatigue were also studied. L. S. G

535.39 = 4 151

New formulae relating to the reflection and transmission of light by a pile of parallel plates. ABELÈS, F. *C.R. Acad. Sci., Paris*, **223**, 891–3 (*Nov.* 27, 1946) *In French.*—Formulae are found for the reflection and transmission coefficients. These apply whether the different media are metallic or not, and thus may be used in a system where thin layers are deposited on metallic supports. L. S. G

535.39 = 4 151

Recurrence formulae and two theorems relating to the reflection and transmission of light by a pile of thin plates with parallel faces. ABELÈS, F. *C.R. Acad. Sci., Paris* **223**, 1112–14 (*Dec.* 23, 1946) *In French.*—A continuation of previous work [Abstr. 1518 (1948)]. Formulae derived there are used to prove 2 theorems about the reflection and transmission coefficients, R and T. One of these states that $R < 1$ always, but T may equal 1. L. S. G

535.39 : 535.66 *see Abstr.* 1530

535.39 : 538.56 = 3 *see Abstr.* 1605

535.39 : 539.26 : 539.234 *see Abstr.* 1677

535.39 : 621.396.1 : 538.56 *see Abstr.* 1606

535.417 : 532.72.08 *see Abstr.* 1459

535.42 152

New methods in diffraction theory. FOCK, V. A. *Phil. Mag.*, **39**, 149–55 (*Feb.*, 1948).—A method based on the "Principle of the Local Field in the Penumbra Region" is outlined. This provides a basis for the approximate solution of the diffraction problem for a convex body of arbitrary shape. The principle is established by two methods. L. S. G

5.421 : 535.33.072 1521

Use of echelette gratings in high orders. WOOD, R. W. *Opt. Soc. Amer.*, **37**, 733–7 (*Oct.*, 1947).—By using ...h orders of an echelette grating (with rulings, say, of ...00 or 1 400 lines/in), and crossing it with a prism or ...other grating to separate the orders, the whole of the ...ible region can be got into a small compact area, in ...ips roughly parallel to one another, corresponding to ...cessive orders. By careful selection of the grating, ...e may be chosen which gives sufficient intensity in high ...lers, and the advantage is that the whole of the region ...uired may be got on to a plate so that every part is ...ar to the axis of the lens. As an example, using a lens ...3-in aperture, 30-in focus, for the camera, and a lens ...4-in aperture, 5-ft focus for the collimator, an ...00-line/inch grating crossed with the 1 400-line/inch ...ting, the whole solar spectrum was photographed on ...late 2-in square, from H_α to H_γ. The dispersion was ...uivalent to that given by a grating of 14 400 lines per ...h, requiring a plate 2 ft in length. Two lines 0·3 Å ...art were resolved. A. C. M.

5.421 : 538.566 1522

Diffraction of electromagnetic waves. TRANTER, W. O. *...ys. Rev.*, **73**, 184 (*Jan.* 15, 1948).—Two vertical ...activated dipoles were placed in the path of electro-...agnetic radiation, and curves are given for the variation ...signal strength in the space between the two dipoles ...the three cases where their distances apart were λ, ...and 3λ. The results are compared with those of ...drews [Abstr. 2118 (1947)] for a circular aperture, ...d a qualitative explanation is given. W. E. D.

5.43 : 535.51 1523

The resonance radiation induced by elliptically polarized ...ht. HAMILTON, D. R. *Astrophys. J.*, **106**, 457–65 (*...ov.*, 1947).—The Dirac radiation theory is applied to ...e calculation of the angular distribution and polariza-...on of the resonance radiation induced by totally or ...rtially elliptically polarized light. The results show ...me deviations from Rayleigh's classical formula. The ...rrelation in polarization and direction of propagation ...two successive quanta emitted by a radiating system ...also obtained. L. P.

5.43 : 537.531 : 548.73 *see Abstr.* 1704

5.434 : 535.51 = 4 1524

Depolarisation of polarized light produced by Chris-...ansen mixtures. BOUTARIC, A., AND BERTHIER, P. *...ev. Sci., Paris*, **85**, 619–21 (*June* 1 *and* 15, 1947) *In ...ench.*—A study of the factors influencing the de-...olarization produced by powder-liquid mixtures. Both ...rticle size and the index of the liquid medium with ...spect to the powder are found to influence the de-...olarization, but birefringence of the powder has an ...verriding effect in that complete depolarization is ...oduced even by the thinnest layers no matter what the ...ain size or liquid index. In the case of optically ...otropic powders, the depolarization passes through a ...inimum when the powder-liquid relative index is ~ 1. H. H. HOP.

35.434 : 535.51 = 4 1525

Influence of the medium of dispersion on the polarisation ...oduced by crystalline suspensions. BOUTARIC, A., AND ...ERTHIER, P. *Rev. Sci., Paris*, **85**, 621–2 (*June* 1 *and* 15, ...947) *In French.*—Continuing earlier work [see Abstr. ...524 (1948)], it has been found that the factors influencing ...ne polarization produced by crystalline suspensions ...arallel those influencing the depolarization produced by ...quid-powder mixtures. The use of birefringent crystals for polarizing suspensions is desirable as was found by Procopiu. In other cases the polarization passes through a minimum when the crystal and liquid have nearly the same index. H. H. HOP.

535.434 : 535.51 : 541.182.6 = 4 1526

The intensity and polarization of light scattered by silver sols. GUINAND, S., AND TONNELAT, J. *C.R. Acad. Sci., Paris*, **225**, 1029–31 (*Nov.* 24, 1947) *In French.*—The results of experiments designed to test the applicability of the treatment of Gans [Abstr. 1232 (1920)] are briefly reported. It is concluded that the theory is invalid for particles whose dimensions $> \lambda/20$, where λ is the wavelength of incident light. R. F. B.

535.436 : 533.6.011.5 1527

Light scattering in supersonic streams. MCQUEEN, J. H., BEAMS, J. W., AND SNODDY, L. B. *Phys. Rev.*, **73**, 260 (*Feb.* 1, 1948).—The mean density variation at any point in a supersonic air stream can be determined by measuring the intensity of light scattered through various angles by the stream. W. E. D.

535.51 : 535.43 *see Abstr.* 1523

535.51 : 535.434 = 4 *see Abstr.* 1524–5

535.51 : 539.185 *see Abstr.* 1669

535.51 : 541.182.6 : 535.434 = 4 *see Abstr.* 1526

535.515 : 621.396.11 : 538.566.3 *see Abstr.* 1607

535.52 : 548.0 1528

A simple universal model for representing the optic orientation of biaxial crystals. HARTSHORNE, N. H. *Nature, Lond.*, **161**, 94–5 (*Jan.* 17, 1948).

535.543 : 548.0 : 537.226.2 *see Abstr.* 1545

535.551 : 532.52 : 532.74 = 393 *see Abstr.* 1460

535.6 : 539.16 : 548.0 = 3 *see Abstr.* 1698

535.64 1529

Interrelation of colour specifications. NICKERSON, D. *Paper Tr. J.*, **125**, *TAPPI Sect.*, 219–37 (*Nov.* 6, 1947).—Methods of graphing and transforming I.C.I. colour specification data are discussed, and sets of standard reference material used for such conversions are listed in tabular form. They are based on dominant wavelength-purity data, the Ostwald system, the Maerz and Paul "Color Dictionary," the Lovibond glasses, and Wratten filters. The problem of colour tolerance specification is also reviewed, and formulae for evaluating tolerance are summarized. J. G.

535.66 : 535.39 1530

Relation of gloss to colour. HUNTER, R. S. *Paper Tr. J.*, **126**, *TAPPI Sect.*, 13–16 (*Jan.* 8, 1948).—Gloss is responsible for weakening the apparent colour of an object whenever, owing to diffuse illumination, the effects of specular reflectance are added to those of diffuse reflectance which gives the appearance of colour. Geometric patterns of reflected light may be represented by goniophotometric curves, which, however, do not in general follow exactly the classical simple patterns. Consequently, accurate and complete separation of light reflected from a surface due to gloss, and that due to diffuse reflectance, is not possible. There are, therefore, a number of scales for assessing the value of gloss, each suitable for a particular type of material. Six such suggested scales are tabulated, together with their applications to various materials. J. G.

535.8 : 681.4 = 4 1531

The production of aspheric surfaces. TWYMAN, F. *Rev. Opt.* (*Théor. Instrum.*) **26**, 461–78 (*Dec.*, 1947) *In French.*—Both a historical review and a survey of present-

day techniques in use in various countries. Methods of production and testing are classified and described.
H. H. HOP.

HEAT 536

536.1 : 537.12 = 3 *see Abstr.* 1541

536.2.02 1532

Thermal mutual inductance. BOSWORTH, R. C. L. *Nature, Lond.*, **161**, 166–7 (*Jan.* 31, 1948).—[See Abstr. 2861 (1946)]. The temperature of a horizontal wire in a fluid (conc. sucrose solution) was measured when a parallel wire below it was suddenly heated by a current. The temp. exhibited both transient and permanent changes, the former rising to a peak and falling again. This represents the impulsive kinetic energy in the convection currents during the establishment of the steady state.

536.23 1533

The thermal conductivity of carbon dioxide between −78·50°C and 100°C. KANNULUIK, W. G., AND LAW, P. G. *Proc. Roy. Soc. Vict.*, **58** (*Pts I–II*) 142–56 (1947).—The thermal conductivity, k, of dried CO_2 gas, prepared by heating pure $NaHCO_3$, was measured at the CO_2, ice and steam points, for various pressures, p, between 2 mm Hg and atmospheric. The short thick wire method was used [see Abstr. 2550 (1934)]. The apparatus consisted of an electrically heated Pt wire ($R_0 = 0{\cdot}00639591\ \Omega$ and $\delta = 1{\cdot}49$) mounted axially in a stainless steel tube immersed in a constant temp. bath. By extrapolation of the straight portion of the graph of $1/k$ *v.* $1/p$, the values of k, 1·97, 3·50 and $5{\cdot}46\times10^{-5}$ cal/cm sec deg at the respective points, unaffected by the temp. discontinuities at the wire and inner tube surfaces, were deduced. The thermal conductivity of the Pt wire was obtained by measurements made with the tube highly evacuated ($< 10^{-5}$ mm Hg). An approximate, and the exact, theory of the method is derived mathematically. S. W.

536.242 = 4 1534

Transmission of heat by a cylinder and a sphere in a current of gas. TCHUKHANOV, Z. F. *C.R. Acad. Sci. URSS*, **52** (*No.* 8) 679–82 (1946) *In French.*—Graphs are drawn showing the angular variation of the intensity of heat transmission for various velocities of the gas stream, which may be normal or oblique to the surface of the cylinder. Empirical equations representing the curves are given. L. S. G.

536.25 : 533.6.011.6 = 4 1535

Forced convection of heat from the surface of a body of revolution. BRUN, E., AND VASSEUR, M. *C.R. Acad. Sci., Paris*, **225**, 861–3 (*Nov.* 3, 1947) *In French.*—A complete analogy is established between the problem of determining the convection of heat from a cylinder by a stream of fluid flowing in planes at right angles to the generators, and the corresponding problem of the convection of heat from a solid of revolution by a stream of fluid flowing, at infinite distance, parallel to the axis of the solid. G. G.

536.25 : 536.48 : 539.155.2 *see Abstr.* 1625

536.421.4 = 4 1536

Time of freezing for a supercooled drop of water. MAURIN, J. *C.R. Acad. Sci., Paris*, **225**, 814–16 (*Nov.* 3, 1947) *In French.*—Assuming the drop remains spherical and isotropic, and neglecting the variation of saturation pressure due to its curvature, an equation is obtained for the time taken for a drop at $\theta°$ to rise to 0°C and solidify. This gives for a drop of 15 μ diameter with 100% r.h. a time of 0·03 sec for $\theta = -5$°C and of 0·20 sec for $\theta = 0{\cdot}5$°C. The theory was tested by experiment by method described; the agreement was good. R. S. I.

536.423 : 542.48 = 3 *see Abstr.* 1691

536.424 : 548.33 *see Abstr.* 1701

536.46 : 535.338.4 *see Abstr.* 1493

536.46 : 535.338.4 = 4 *see Abstr.* 1494

536.46 : 539.132 *see Abstr.* 1610

536.48 : 536.25 : 539.155.2 *see Abstr.* 1625

536.48 : 536.65 = 3 *see Abstr.* 1538

536.48 : 536.7 153

On the thermodynamics of the fountain phenomenon i liquid helium II and its inverse effect. DE GROOT, S. R *Physica, 's Grav.*, **13**, 555–7 (*Nov.*, 1947).—[See Abstr 3515 (1947)].

536.63 : 537.312.62 = 3 *see Abstr.* 1558

536.65 : 536.48 = 3 153

Results of low temperature research. IV. Molar heats heats of transformation and fusion and entropies of DCl DBr and DI. CLUSIUS, K., AND WOLF, G. *Z. Naturforsch.*, **2a**, 495–504 (*Sept.*, 1947) *In German.*—Th measurements cover the range between 15°K and th boiling point. The D compounds compare with th corresponding H compounds as follows: the mola heats and the heats of transformation at the transitio points are higher, the heats of fusion lower. Th transition temperatures are a few degrees higher and th melting points a few tenths of a degree lower. The triple point pressures are 5 to 15% lower. The caloric an statistical entropies at the boiling point are compared fo DBr and for DI and are found to agree well. H. L.

536.655 153

A note on the heat of evaporation and the calculation o Trouton's constant. STEENSHOLT, G. *Phil. Mag.*, **38** 752–6 (*Oct.*, 1947).—The constant is $A = \Lambda/kT$, when Λ = molecular heat of evaporation, T = boiling poin of a liquid, k = Boltzmann's constant. A previou theoretical calculation [Abstr. 1683 (1938)] gives A = 10·3; a more accurate calculation now gives the bette value 8·9 to 9·0. L. S. G

536.655 : 541.265 154

Latent heat of vaporization and composition. BOWDEN S. T., AND JONES, W. J. *Phil. Mag.*, **39**, 155–61 (*Feb.* 1948).—The normal and true lyoparachors for a large number of non-associated organic liquids with boiling points between 200°C and −100°C are calculated, an compared with experimental values. The agreement i good. Provisional values for atom and bond constant are deduced. L. S. G

THERMODYNAMICS 536.7

536.7 : 530.12 *see Abstr.* 1423

536.7 : 536.48 *see Abstr.* 1537

ELECTRICITY 537

537.12 : 536.1 = 3 154

The effect of the exchange energy on the specific heat o an electron gas. KOPPE, H. *Z. Naturforsch.*, **2a**, 429–3 (*Aug.*, 1947) *In German.*—The specific heat $\propto T$ at low temperatures, when the exchange energy is included, bu in this approximation it is about 40% smaller for th alkali metals than the value given by the Sommerfel theory. G. J. K

537.122 : 530.145 154

On the theory of point electrons. LEWIS, T. *Phil. Mag.* **39**, 116–22 (*Feb.*, 1948).—Further remarks [Abstr. 162

46)] concerning Dirac's theory [Abstr. 3660 (1938)]. cases of a single electron in an external field and of ystem of interacting electrons are considered. [See Abstr. 960 (1948)]. L. S. G.

.122 : 530.145 = 3 *see Abstr.* 1431

.122 : 537.527.5 = 3 *see Abstr.* 1573

.122 : 538.3 : 530.145 *see Abstr.* 1432

.122 : 538.615 : 539.181 : 539.153 *see Abstr.* 1620

.122 : 539.166 *see Abstr.* 1641

.133 : 539.152.1 *see Abstr.* 1616

.226 = 4 1543

Theory of polar dielectrics. Changes of mono- and timolecular orientations. BAUER, E. *Cah. de Phys.*, 27) 33–8 (*June*, 1945) *In French.*—The author's ory and that of Slater are derived by analogous con- erations. Both take into account reaction velocity, whereas the author considers displacement of mono- lecular equilibria, Slater considers multimolecular uilibria displacement. Slater's effects should not be portant at temperatures below that at which free ation sets in. W. R. A.

.226 : 539.13 1544

Dielectric relaxation of molecules containing rotating ar groups. BUDÓ, A. *Nature, Lond.*, **161**, 133 *n.* 24, 1948).

.226 : 539.132 *see Abstr.* 1611

.226.2 : 535.543 : 548.0 1545

Structure, electrical, and optical properties of barium nate. MATTHIAS, B., AND VON HIPPEL, A. *Phys. Rev.*, 268 (*Feb.* 1, 1948).—Some of the properties of $BaTiO_3$ surveyed, with reference to recent publications. W. E. D.

.228.1 : 539.32 : 549.514.51 1546

Calculation of the piezo-electric constants of α- and quartz. SAKSENA, B. D. *Nature, Lond.*, **161**, 283–4 *b.* 21, 1948).

.228.5 : 539.133 : 535.343.4–14 *see Abstr.* 1502–3

ELECTRIC CURRENTS 537.3

.311.23 : 548.0 : 621.3.011.2 : 669.776 1547

On the electrical conductivity of selenium crystals. BOER, F. *Philips Res. Rep.*, **2**, 352–6 (*Oct.*, 1947).—or the specific resistance of Se monocrystals parallel to c-axis, values ranging from 2×10^4 to $5\times10^4\ \Omega$ cm were served; it is probable that the specific resistance of a re monocrystal lies near the lower end of this range. e specific resistance at right angles to the c-axis was $<10^6\ \Omega$ cm. Experiments were carried out on the fluence of temperature and pressure on the conductivity. A.

.311.33 : 539.234 1548

High-frequency characteristics of lead sulphide and lead lenide layers. CHASMAR, R. P. *Nature, Lond.*, **161**, 1–2 (*Feb.* 21, 1948).—The shunt resistance of the cells eadily decreases as frequency rises, and at 60 Mc/s is nly a fraction of the d.c. value. Moreover, at this equency the temp.-dependence is quite small. The noto-conductive effect, however, disappears with rising equency, which supports the theory that it is associated ith the intercrystalline barriers [Abstr. 969 (1948)]. he microcrystals are semi-metallic.

.311.37.029.5 : 537.525 : 621.385.132 1549

Radiofrequency conductivity of gas-discharge plasmas the microwave region. GOLDSTEIN, L., AND COHEN, . L. *Phys. Rev.*, **73**, 83 (*Jan.* 1, 1948).—A coaxial line corporating a gas-discharge tube as a dielectric gap in the centre conductor was used. The attenuation of the r.f. signal in passing through the gas varies little with increased d.c. through the gas up to 10 mA, but drops very sharply between 10 and 100 mA. Investigations showed that h.f. oscillations existed in an ordinary d.c. discharge, whose amplitude increased with increasing d.c. W. E. D.

537.312.5 = 3 1550

Theory of barrier-layer photoelectric effects. II. LEHOVEC, K. *Z. Naturforsch.*, **2a**, 398–403 (*July*, 1947) *In German.*—The differential equations obtained in I [see Abstr. 875 (1947)] are integrated and a general relationship involving photo-electric voltage, current, and light intensity is derived. Its implications are considered, briefly in respect to barrier-layer rectifiers, and more fully for photo-cells, by examination of special cases of the final equation. C. C.

537.312.5 : 535.215 = 3 1551

Variation of photo-electric emission of zinc, cadmium and aluminium layers during transition from random to ordered state and effect of temperature on sensitivity of these metals. SUHRMANN, R., AND PIETRZYK, J. *Z. Phys.*, **122** (*Nos* 9-12) 600–13 (1944) *In German.*—Layers of Zn, Cd and Al respectively are condensed on a cooled glass plate at 83°K in a high vacuum, and the spectral photoelectric sensitivity is measured. The condensed metal layers are in a random state and are brought into an ordered state by heating to 293°K. The spectral sensitivity is then again measured at 293°K and also 83°K. The emission potentials were found the same in the random and ordered states, namely, Zn, $4{\cdot}307\pm0{\cdot}007$ V; Cd, $4{\cdot}099\pm0{\cdot}009$ V; and Al, $4{\cdot}20\pm0{\cdot}02$ V. The yield and the number of emitting centres, however, is greater in a random state than in an ordered state by 30–60%. The decrease of sensitivity due to reduction in number of emitting centres increases the smaller the number of the metal element considered in the periodic table. V. W. R.

537.312.5 : 535.215 : 621.383.2 1552

The optical and photo-electrical properties of antimony-caesium cathodes. MORGULIS, N. D. *C.R. Acad. Sci. URSS*, **52** (*No.* 8) 675–8 (1946).—An experimental study was made of absorption of light quanta by photo-electron emitters, the excitation of photoelectrons and the kinetics of their motion towards the surface of the emitter; special photocells of Sb–Cs were prepared. The absorption coefficients of the quanta and the photoelectrons were measured for these wavelengths of the light irradiating the photocathode: 630, 560, 490 and 420 mμ. L. S. G.

537.312.5 : 535.33–15 : 621.383.4 1553

Lead telluride cells for infra-red spectroscopy. SIMPSON, O., SUTHERLAND, G. B. B. M., AND BLACKWELL, D. E. *Nature, Lond.*, **161**, 281 (*Feb.* 21, 1948).—Cells have been constructed which are 100× as sensitive as a vacuum thermocouple between 2 and 3 μ, and equal at $4{\cdot}6$ μ. There is still some sensitivity at $5{\cdot}5$ μ. The cells were operated at liquid air temperature.

537.312.5 : 621.383.4 1554

Spectral response of lead selenide. MOSS, T. S., AND CHASMAR, R. P. *Nature, Lond.*, **161**, 244 (*Feb.* 14, 1948).—The preparation of cells of microcrystalline layers of PbSe with a window of *KRS5* (TlBr/TlI mixture) is described. Spectral response curves taken at 195° and 90°K are shown; they have cut-offs at ~4 μ and 5 μ respectively. [See Abstr. 971 (1948)].

537.312.5 : 621.383.4 = 3 1555

A photo-electric noise effect. REICHELT, W., AND BECKER, A. *Z. Naturforsch.*, **2a**, 403–9 (*July*, 1947) *In German.*—It was found that the conductivity of CdS–Cu

phosphors measured in a d.c. circuit was not constant, but exhibited noise, contrary to the case in ZnS or CdS phosphors. The influence of light intensity, applied voltage and wavelength on the noise amplitude was investigated. The preparation of the material and the cell are described. The mechanism of the effect is briefly discussed, the conclusion being that the noise is not due to variable contacts between the individual crystals.

A. H. W. B.

537.312.62 1556

Superconductivity and the Debye characteristic temperature. DIXIT, K. R. *Phys. Rev.*, **73**, 182–3 (*Jan.* 15, 1948).—It is pointed out that it can be deduced from the relation between superconductivity threshold temp. and the Debye characteristic temp. given by Launay and Dolecek [Abstr. 2899 (1947)] that a substance will not become superconducting if it has not already done so by the time it cools to $\sim 0{\cdot}7°K$. W. E. D.

537.312.62 = 3 1557

"Plasma oscillations" as the cause of superconductivity. MÖGLICH, F., AND ROMPE, R. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 27–40 (1947) *In German.*—The authors base their treatment on the equations of infinite conductivity of Becker, Heller and Sauter [Abstr. 5413 (1933)], from which they claim to be able to derive the equations of F. and H. London without introducing a further assumption. A new departure is the introduction of a restoring force for charge variations based on the zero point pressure in Sommerfeld's theory. This gives rise to a new type of longitudinal wave. The analogue of the Debye spectrum of these and the transversal waves is calculated. Since both waves have frequencies $> 10^{15}$ sec^{-1} they make no noticeable contribution to the thermodynamic functions of the superconductor. H. L.

537.312.62 : 536.63 = 3 1558

The specific heat of superconductors according to Heisenberg's theory. KOPPE, H. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 405–14 (1947) *In German.*—It is shown that the specific heat C_v and the transition curve can be calculated from the Heisenberg model [Abstr. 3203 (1947)] without any further hypotheses. In particular a relation is obtained, valid for all superconductors, between $C_v(T)/C_v(T_c)$ and T/T_c (T_c = critical temperature) which agrees well with experiment. H. L.

537.312.62 : 548.73 1559

Superconductivity and structure of hydrides and nitrides of tantalum and columbium. HORN, F. H., AND ZIEGLER, W. T. *J. Amer. Chem. Soc.*, **69**, 2762–9 (*Nov.*, 1947).—On the basis of published data on the superconducting interstitial alloys it is concluded that, in a series of such alloys containing the same parent metal, the superconducting transition temperature varies inversely with the dimension of the lattice parameters if the same crystal structure is maintained. This is borne out by magnetic studies on hydrides of Ta and Cb and on CbN. X-ray investigations have been conducted on these systems and on CbN and TaN. The transition temperature for CbN is $15{\cdot}2°K$ (the highest temperature yet recorded for a superconductor). TaN is not a superconductor above $1{\cdot}88°K$. W. R. A.

537.315 : 621.317.32 = 4 1560

The Volta effect. NADJAKOV, G. *C.R. Acad. Sci., Paris*, **225**, 1061–3 (*Dec.* 1, 1947) *In French.*—A new method of measuring contact p.d. is described. Two quadrants are removed from a thick circular disc of the material whose contact p.d. is required and a light rotor of the type used in quadrant electrometers, of the standard material, is suspended above the resulting block. A potential is applied between block and rotor and a sma subsidiary supply is adjusted until no deflection occu on reversing the main supply. The subsidiary voltage then equal to the contact p.d. A. H. W.

537.323 = 3 15

Thermo-voltages between silicon carbide, copper an platinum. BUSCH, G., SCHMID, P., AND SFÖNDLIN, *Helv. Phys. Acta*, **20** (*No.* 6) 461–3 (1947) *In German.*— Measurements of thermoelectric power were carried o between 75°K and 1 000°K. Green and black specime of SiC were found to give thermo-e.m.f.s of opposi sign, in accordance with the different nature of the impurity centres. The thermoelectric power increas almost linearly with increasing abs. temperature, mo rapidly for black SiC than for the green variety. Th existence of a positive correlation between thermoelectr power and activation energy was confirmed. H. K.

537.36 15

Theory of electrokinetic effects. BOOTH, F. *Natur Lond.*, **161**, 83–6 (*Jan.* 17, 1948).—A summary of t present position (19 refs.) and preliminary account of ne mathematical results.

ELECTRIC DISCHARGES AND RADIATIONS 537

537.52 : 535.37 : 535.338.4 = 4 *see Abstr.* 1492

537.521.7 = 3 15

Theory of the electric spark. WEIZEL, W., AND ROMP R. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*No.* 6) 285–300 (*Aug* 1947) *In German.*—Four distinct stages of spark breal down are considered: (*a*) ignition stage, when the spa channel is formed and little energy taken from the e.m. source; (*b*) spark plasma stage, when channel is heate by an aperiodic discharge and not all the energy is take from source; (*c*) stage of damped current oscillatio when all energy of source—e.g. spark condenser—is us up; and (*d*) after-glow stage when radiation is emitt after previous electrical processes are completed. In a four stages electron energy is the predominant facto Estimates are made of the relaxation time required t attain equilibrium in various ionizing processes aft application of e.m.f. The influence of inductanc capacitance and resistance of the spark circuit on th four stages is discussed. A time-constant parameter introduced which determines spark duration, and whic increases with gas pressure and spark length. A pe turbation of the normal Maxwellian distribution electrons is smoothed out in 10^{-13} sec at atmospher pressure, but attainment of equilibrium between ato and electrons is slow, taking 10^{-5} or 10^{-6} sec. The mai discussion in the paper covers complete breakdow phases and not ignition of sparks. F. LL.

537.521.7 = 3 156

On Toepler's spark law. ROMPE, R., AND WEIZEL, W *Z. Phys.*, **122** (*Nos* 9–12) 636–9 (1944) *In German.*— Investigates the variation in resistance of a gas discharg during the initial period of voltage breakdown an ionization between the electrodes. According to Toepl the conductance $\propto$ the current integral. The autho develop another theory from fundamental consideration and find (conductance)$^2 \propto$ (integral of current)^2. E perimental evidence seems to corroborate the theory. V. W. F

537.523 : 537.533.92 = 3 *see Abstr.* 1581

537.523 : 77.019.2 *see Abstr.* 1725

537.523.4 : 621.3.015.5 15

Gas discharges at centimetre wavelengths. PROWS W. A., AND COOPER, B. *Nature, Lond.*, **161**, 310–

28, 1948).—The breakdown voltage between rodes forming part of a resonant cavity was in- gated at 2 800 and 9 800 Mc/s, both for individual s and pulses repeated at 400 per sec. The behaviour appearance of the discharge, and the effect of irradi- with u.v. light and Ra, are described.

523.5 = 3 1566

e "singing" of homogeneous carbon arcs. SCHLUGE, AND FINKELNBURG, W. *Z. Phys.*, **122** (*Nos* 9–12) 39 (1944) *In German.*—The "singing" arc was stigated by means of oscilloscopes and photographs. relation between current, voltage, phase angle, note ted, brightness and type of carbons was studied. An ratus for taking high-speed photographs of the arc scribed and results are shown. "Singing" threshold tendency are investigated and the mechanism under- the singing arc is discussed. V. W. R.

525 = 3 1567

emarks on the theory of cathode potential drop. IGER, R. *Z. Phys.*, **122** (*Nos* 1–4) 209–15 (1944) *In man.*—The form of mathematical relation between tron-impact ionization and field strength required to elate cathode p.d. characteristics with experimental lts is discussed. A simple mathematical relation is red to give a clear physical picture, and the simplified ory of v. Engel and Steenbeck is further simplified convenient area-relation. The relation is quanti- ely in accordance with the physical limits. V. W. R.

525 : 621.327.4 = 3 1568

Measurements of the positive column gradient of low sure rare gas discharges. Positive characteristic. MELLENMEIER, H. *Z. Phys.*, **122** (*Nos* 5–8) 269–84 44) *In German.*—The positive column of a low-pressure discharge usually has a negative resistance character- , and lamps of this type require series ballast. periments were carried out with tubes 60-cm long varying diameters and degrees of vacuum containing He, A and Kr. A positive voltage character- could be obtained with a certain range of pressures diameters. Small tube diameter and high vacuum conducive to positive characteristic. The charac- stic becomes negative, however, beyond a certain rent. Positive characteristic lamps can be mains- rated without ballast. The phenomenon is thought be due to the observed difference in pressure at the de and cathode end of long tubes, due to the discharge. V. W. R.

.525 : 621.385.132 : 537.311.37.029.5 *see Abstr.* 1549

.525.5 : 537.562 = 4 1569

Discharge mechanisms in high frequency arcs. EYRAUD, *C.R. Acad. Sci., Paris*, **225**, 939–40 (*Nov.* 17, 1947) *French.*—Certain peculiarities, i.e. successive maxima minima of activity, were noticed in chemical reactions olving an oxide of nitrogen (NO) in h.f. discharges. y are, it is claimed, explicable if there is a non- iform distribution of N_2^+ ions in the discharges and ertain other, generally allowed, assumptions are made. e argument is briefly developed. J. D. C.

7.527.4 1570

Spark breakdown at atmospheric pressure and above in ation to Paschen's law. MILLER, C. G., AND LOEB, L. B. *ys. Rev.*, **73**, 84–5 (*Jan.* 1, 1948).—Calculations on arking potentials at high pressures for three given essures show: (*a*) that Paschen's law does not hold in at high pressures; (*b*) that the departure is what would expected from the streamer mechanism; and (*c*) that the Meek–Raether criterion [Abstr. 5024 (1938)] requires amplification to include photo-electric absorption. W. E. D.

537.527.5 1571

Influence of cooling conditions on high pressure discharges. ELENBAAS, W. *Philips Res. Rep.*, **2**, 161–70 (*June*, 1947).—Experiments on the variation of voltage gradient along a high-pressure Hg vapour arc due to changes in tube wall temperature are described. Theoretical derivations of the gradient for the cases of constant pressure and constant density are given. For the latter case, and the particular discharge described, 100°C rise in wall temp., expt. gives 1·7–2% increase in gradient whilst theory gives 1·8%. The case of convection-stabilized discharges is also discussed. J. D. C.

537.527.5 = 3 1572

The question of stabilising free-burning arcs. ROMPE, R., THOURET, W., AND WEIZEL, W. *Z. Phys.*, **122** (*Nos* 1–4) 1–22 (1944) *In German.*—The arc stability theory of Elenbaas [Abstr. 3845 (1934)] is applicable only to arcs in cylindrical tubes in close proximity to the walls. The paper investigates the theory of electric arc discharge for free-burning arcs remote from the walls as in high-pressure Hg-arc lamps with spherical bulbs. The case of a free-burning arc with finite electrode distance is mathematically treated by elliptic functions. The arc-stability, according to the pressure, rating and electrode dimensions of the lamp, is determined either by (*a*) convection currents, (*b*) contraction of the discharge at the electrodes due to the mechanism of charge transfer, (*c*) limitation in axial direction due to electrode spacing and dimensions. Experiments and photos of the various types of arcs with vertical, horizontal and rotating electrode systems are included. V. W. R.

537.527.5 : 535.338 = 3 *see Abstr.* 1486

537.527.5 : 537.122 = 3 1573

The influence of positive ions on electron mobility. 1. The electron mobility in a high pressure plasma. SCHULZ, P. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 318–32 (1947) *In German.*—Measurements were made on ion densities, by observing spectral line widths in high-pressure (30–40 atmos.) discharges in Hg, Kr and Xe for a current range of approx. 10–30 A. Electrical measurements of current densities used in conjunction with the electron and ion concentrations (assumed practically equal in the plasma) enabled total cross-sections (N_+Q_+) to be calculated. The ambipolar mobility gives a mean free path $\lambda = 1/(NQ + N_+Q_+)$ which was determinable from the experimental data. The ion concentrations $\simeq 10^{16}/\text{cm}^3$ and $Q_+ = 2{\cdot}2\text{–}3{\cdot}7\times10^{-13}$ cm², depending on experimental conditions ($Q \simeq 0{\cdot}9\text{–}1{\cdot}18\times10^{-16}$ cm²). J. D. C.

537.531 : 535.31 = 3 1574

Contribution to geometric-optic magnification with X-rays. KELLERMANN, K. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 1–2) 32–6 (1943) *In German.*—Part of a beam of parallel X-rays impinging on a cylindrical surface suffers total reflection and gives a sideways-spreading beam of rays. An object in the path of those parallel rays which are later totally reflected can thus be magnified. This magnification is mathematically calculated and tabulated for crown glass, Ag, glycerine and $CaCl_2$ cylinders of varying radii. With large radii the magnification varies from positive to negative values according to the curvature. Rods of small radii were previously used and these required a high degree of optic precision due to the large curvature and magnification. To obtain magnification of areas two cylinders at right angles are employed. V. W. R.

537.531 : 535.36 : 548.736.442 = 4 *see Abstr.* 1710

537.531 : 535.43 : 548.73 *see Abstr.* 1704

537.533 : 548.0 = 3 1575

Electron emission from crystalline metal surfaces and its relation to the crystal structure. I. Pure metal surfaces. STRANSKI, I. N., AND SUHRMANN, R. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 153–68 (*May*, 1947) *In German.*—The relation between the emission from the faces of metal crystals is discussed in relation to the crystal constants, using W as an example. The relationship between work function and the specific surface energy appears to be worth further study. Low surface energy goes with high work function, which explains the phenomenon in which the work function of a surface can be lowered by deposition of a partial layer of the same substance. For II, see Abstr. 1576 (1948). A. H. W. B.

537.533 : 548.0 : 541.183 = 3 1576

Electron emission from crystalline metal surfaces and its relation to the crystal structure. II. Single crystal surfaces with adsorbed impurity atoms. STRANSKI, I. N., AND SUHRMANN, R. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 169–80 (*May*, 1947) *In German.*—For I, see Abstr. 1575 (1948). The mechanism of the adsorption of Cs and Ba atoms on crystalline W is considered. Cs is first adsorbed on the 112 face and next on the 011 face. The covered spots spread and emission increases when the adsorbed film is thick enough, again first on the 112 face. The formation of layers is shown to depend on the lattice constant, the atomic diameter of the impurity, and on the work function of the crystal face. Thus on the 001 face of W only atoms of diameters 3·1, 4·5, 6·3, 8·9, etc., Å can form films. On the 111 face the values are 4·5, 8·9, etc., Å. The adsorption and migration energies are discussed, as is the formation of layers more than one atom thick. A. H. W. B.

537.533.72 : 538.691 = 4 1577

Caustics of particle trajectories obtained by the method of trochoids. THIBAUD, J. *C.R. Acad. Sci., Paris*, **225**, 934–6 (*Nov.* 17, 1947) *In French.*—A method is described for distinguishing groups of fast particles emitted in random directions from a small source by allowing them to pass through an inhomogeneous magnetic field. Particles of given $H\rho$ will be found only in a sharply limited region, and if mixtures of groups of β-particles, for example, are allowed to fall on a suitably placed photographic plate, the limits corresponding to max. $H\rho$ for the different groups are clearly marked. J. H. F.

537.533.72 : 548.74 1578

Index of refraction for electrons in crystalline media. STURKEY, L. *Phys. Rev.*, **73**, 183 (*Jan.* 15, 1948).—The small correction to the inner potential is discussed and an expression is given for the vector angular deviation, δ, from the Bragg reflection angle in the case of the cubic crystals MgO and CdO. Two positive and two negative values of δ occur for these crystals, and from these values an accurate value of V_0, the "inner potential," can be obtained. A table of such values is given as deduced from the [200] and [220] reflections. W. E. D.

537.533.73 1579

Refraction effects in electron diffraction and in electron microscopy. RAETHER, H. *Nature, Lond.*, **161**, 311 (*Feb.* 28, 1948).—[See Abstr. 1881 (1947)].

537.533.73 : 539.133 *see Abstr.* 1613

537.533.73 : 539.234 = 3 *see Abstr.* 1676

537.533.8 : 548.0 = 3 1580

The mechanism of secondary emission from the interior of ionic crystals. KNOLL, M., HACHENBERG, O., AND RANDMER, J. *Z. Phys.*, **122** (*Nos* 1–4) 137–62 (1944) *German.*—The secondary emission of KCl ionic crysta was studied with electron bombardment velocities 0·5–10 kV. The secondary yield factor δ is greater wi crystals than with metals and decreases with rising tem Long exposure to electron beams results in reduced due to absorption of secondary electron by "*F*-centres colloidal K, and can be restored by tempering. Form tion of *F*-centres by ultra-violet rays gives similar resul Higher intensity electron beams reduce δ due to destru tion of the lattice. Absorption of secondary electro is due also to conduction-electrons caused by light electron beam bombardment. The secondary electro in insulator-crystals have a relatively larger free path th those in metals. The secondary emission of crystalli insulators and metals and highly emissive metal alloys discussed in the light of the experimental results. V. W.

537.533.9 : 548.0 = 3 *see Abstr.* 1699

537.533.92 : 537.523 = 3 15

Remarks on the ionisation density of an electron pat RIEMANN, W. *Z. Phys.*, **122** (*Nos* 1–4) 262–5 (1944) *German.*—Describes an experiment on initiating electr discharges in a gas remote from the electrodes by X-r radiation. The discharges were photographed by mea of a cloud-chamber. The electrons of the discharge mo to the anode, while a plasma-type discharge towards t cathode was observed from the starting point, th completing an anode-cathode connection. The dischar towards the cathode is thought to be due to phot electrons caused by ionizing radiations from the startir point of the electron discharge in the cloud chambe This is similar to the result obtained by Raether [Abst 2969 (1939)]. V. W.

537.534 : 539.155.2 = 3 15

An ion source for mass-spectroscopic isotope separ tion. WALCHER, W. *Z. Phys.*, **122** (*Nos* 1–4) 62–8 (1944) *In German.*—Mass spectrographic isotope separ tion requires ion beams of extremely uniform velocit The paper describes a suitable apparatus for ionizir atom beams by strong electron bombardment. Wi vapours the desired effect can always be achieve with gases only by use of a vacuum pump and sui able dimensioning of aperture openings. The electr bombardment chamber should be immediately behir the apertures. The optimum accelerating voltages ar dimensions of apparatus are calculated. Tests with a experimental apparatus are described and corrobora the theory. An isotope separation with Ag yielded 99 purity isotopes Ag^{107} and Ag^{109}, the amount bei 1·5 μg each per hour. V. W.

537.542 15

On the resolving time and genuine coincidence loss f Geiger–Mueller counters. MANDEVILLE, C. E., AN SCHERB, M. V. *Phys. Rev.*, 73, 90–1 (*Jan.* 1); *errata*, 6 (*March* 15, 1948).—Construction of G.M. counters described for which the number of double coincidenc produced under given conditions is unaffected by circu resolving times between 0·08 and 1·2 μsec, indicati that there were no pulses delayed in the counters $> 0{\cdot}08$ μsec. [See also Abstr. 659 (1944)]. W. E.

537.542 : 535.215 15

Photoelectric effect in self-quenching Geiger–Muell counters. SCHERB, M. V. *Phys. Rev.*, 73, 86–7 (*Jan.* 1948).—A G–M counter (Cu cathode) with a pe sensitivity to u.-v. at $\sim$ 2 250 Å, after treatment passing a gas discharge at liquid air temp. for about hour, gave a greatly increased sensitivity with a pe response at $\sim$ 3 000 Å. W. E.

42 : 537.591.08 1585

counter apparatus for the measurement of cosmic MIESOWICZ, M., AND JURKIEWICZ, L. *Acta Phys.* ., 9 (*No.* 1) 54–8 (1947).—Preparation and filling of G–M counters of metal construction is described, tests of the life of the counters at high counting J. G. W.

6 : 549.211 : 539.16.08 *see Abstr.* 1630

62 : 537.525.5 = 4 *see Abstr.* 1569

68 : 621.396.11 : 551.510.535 *see Abstr.* 1717

COSMIC RAYS 537.591

91 1586

w Italian cosmic-ray laboratory. *Nature, Lond.*, **161,** *Feb.* 14, 1948).—The laboratory is situated on the slopes of Monte Rosa on the Italo-Swiss border altitude of 11 500 ft.

91 : 523.11 = 3 *see Abstr.* 1392

91 : 539.18 *see Abstr.* 1661

91 : 539.18 = 3 *see Abstr.* 1662

91.1 = 5 1587

search on the hard component of the penetrating tion using magnetized iron cores. CONVERSI, M., AND CCO, E. *Nuovo Cim.*, **1,** 372–413 (*Aug.*, 1943) *In n.*—A magnetic focusing system, consisting of two etized iron cores, one inserted between the first econd counter, and the other between the second hird of a cosmic ray telescope, was used to study nergy spectrum of the hard component. By ging the sense of magnetization of the cores the ve number of either the fast or slow particles can be ased, and from the experiments at 3 500 metres e sea level, assuming an energy spectrum distribution e top of the atmosphere $\sim E^{-2\cdot87}$, a value of $= 2\cdot2\times10^{-8}$ sec/MeV was obtained. Postulating ue of $\tau/\mu c^2 = 3\times10^{-8}$ sec/MeV the corresponding bution appears to be too abundant in slow mesons. bserved that the consistency of the values of $\tau/\mu c^2$ ned by investigations at the two altitudes, excludes ossibility of the existence of several mesons with ent lifetimes. A positive excess of 20% of the nic component is confirmed. G. P. S. O.

91.08 : 537.542 *see Abstr.* 1585

91.15 1588

smic-ray bursts in the upper atmosphere. TATEL, ., AND VAN ALLEN, J. A. *Phys. Rev.*, **73,** 87–8 (*Jan.* 948).—Four ionization chambers filled with A at nos. pressure were mounted in the nose of a V2 et; three gave similar results for number *v.* size of s at heights > 180 000 ft. It is asserted that on the au in the upper atmosphere, where the counting rate onstant, the direct effect of primaries was being ured and that the cross-section for absorption in egion was 0·1 barn (10^{-24} cm²). W. E. D.

91.15 1589

rther results on burst production by penetrating ic-ray particles. BRIDGE, H., HAZEN, W. E., AND T, B. *Phys. Rev.*, **73,** 179–80 (*Jan.* 15, 1948).—A 1 chamber containing 8 parallel ¼-in Pb plates and ered by G–M counters above and an ionization ber below was erected at high altitudes. It was d that the coincidence rate between the counters and ionization chamber increased by a factor of 2·9 een 10 000 and 14 000 ft, compared with a factor of or the total number of penetrating particles (mainly ns). Cloud chamber photographs revealed showers tal energy $\sim 10^{10}$ eV produced by one ionizing particle. Such penetrating particles are thought to be protons, some, possibly, of primary origin and others resulting from nuclear disruptions. The possible mechanism of production of these secondary protons is discussed. W. E. D.

537.591.15 1590

Showers of penetrating particles. WATAGHIN, G. *Nature, Lond.*, **161,** 91–2 (*Jan.* 17, 1948).—The frequency of penetrating showers varies much more rapidly with height than that of single penetrating particles; however, to register coincidences, showers must be relatively local, on account of the spread of the particles, whereas single penetrating particles may originate 20 km or more above the observer. It is suggested that many of these latter are generated also in groups with multiplicity increasing with energy, giving rise to extensive penetrating showers.

537.591.15 1591

On the penetrating component of air showers. SALVINI, G., AND TAGLIAFERRI, G. *Phys. Rev.*, **73,** 261–2 (*Feb.* 1, 1948).—Experiments indicate that the penetrating particles are produced, to a large extent, in the absorbers by the soft component and that they are produced in groups. W. E. D.

537.591.15 1592

Penetrating cosmic ray showers. GEORGE, E. P., AND JASON, A. C. *Nature, Lond.*, **161,** 248 (*Feb.* 14, 1948).—Seven-fold coincidences ("local penetrating showers") were recorded on a set previously described [Abstr. 3568 (1947)] under different thickness of Pb, Al and paraffin wax at an altitude of 3 457 m (Jungfraujoch). For small thicknesses the curves of intensity *v.* thickness coincide, but diverge slightly for greater thickness. The intensity is 28 × sea level [Abstr. 2929 (1947)] giving a range of 120 g/cm² for the primaries causing the showers. Coincidences of the set with a neighbouring counter tray of 1 840 cm² ("extensive penetrating showers") were similarly observed and plotted. These transition curves are typical cascade curves. The intensity is 10 × that at sea level.

537.591.15 1593

Penetrating bursts. GEORGE, E. P., AND TRENT, P. T. *Nature, Lond.*, **161,** 248–50 (*Feb.* 14, 1948).—Bursts in a 1·5 l, 30 atmos. A-filled, ionization chamber shielded by 15 cm of Pb were recorded (altitude 3 457 m) in coincidence with (*a*) a tray of individually recorded, Pb-shielded counters below ("local penetrating bursts"), (*b*) these plus neighbouring trays of air counters ("extensive penetrating bursts"). The results are shown on graphs and discussed. The bursts (*a*) are apparently caused by mesons and contain $\sim 2\frac{1}{2}\%$ of mesons. The majority of the largest bursts are of type (*b*), and for these additional processes beyond the creation and cascade development of high energy electrons and photons by mesons are involved. Burst intensity = 3·9 × sea level.

537.591.15 1594

High altitude measurements on extensive showers. MAZE, R., FRÉON, A., AND AUGER, P. *Phys. Rev.*, **73,** 418 (*Feb.* 15, 1948).—Apparatus incorporating 9 counters spread over 15 m, and recording by perforations in a paper strip, so that coincidences could be discriminated from 3× to 9×, was taken to 22 000 ft in an aeroplane. No important changes are found in the structure of extensive showers up to 22 000 ft; the intensity of large showers at this height is 50 × that at sea level. W. E. D.

537.591.15 = 5 1595

The density spectrum of the extensive air showers. COCCONI, G., LOVERDO, A., AND TONGIORGI, V. *Nuovo Cim.*, **2,** 14–27 (*April*, 1944) *In Italian.*—Measurements at

2 200 metres above sea level, on the density of particles in the extensive showers show that the density is given by the law, already proposed by the authors, $\nu(\Delta) = K\Delta^{-\gamma}$ where $\nu(\Delta)$ is the frequency of showers of density Δ($K = 80$, $\gamma = 2{\cdot}45$). G. P. S. O.

537.591.15 : 539.18 1596

On the production of mesotrons in cosmic-ray stars in the stratosphere. SCHEIN, M., AND LORD, J. J. *Phys. Rev.*, **73**, 189–90 (*Jan.* 15, 1948).—Photographic plates attached to a balloon were exposed to cosmic rays above a height of 60 000 ft for 8 hours. The rate of star production was about 6 000 stars (of $>$ 4 long range tracks) per cm³ of emulsion per day. Some of the stars are described. W. E. D.

537.591.2 : 539.18 = 3 1597

On the question of the types of meson. SCHÄFER, W. *Naturwiss.*, **33**, 365–6 (*Dec.* 30, 1946) *In German.*—Results of Juilfs [*Naturwiss.*, **30**, 584 (1942)] on cosmic ray mesons are discussed on the assumption of two mesons, one light and one heavy, the former having a much shorter life. G. J. K.

537.591.2 : 539.18 = 4 1598

On the hypothesis of two types of mesons and the indirect determination of their mean life. PEYROU, C. *C.R. Acad. Sci., Paris*, **225**, 1065–7 (*Dec.* 1, 1947) *In French.*—A comparison of its intensity at various altitudes suggests that the penetrating component of cosmic rays consists of a single type of meson of lifetime τ where $(\tau/mc^2) = 3\times10^{-14}$ sec^{-1}/eV [Abstr. 105 (1946)]. An alternative explanation is that it consists of a meson $(\tau/mc^2) = 1{\cdot}5\times10^{-14}$ decomposing into a second with $(\tau/mc^2) = 2\times10^{-14}$. G. J. K.

537.591.3 : 539.18 *see Abstr.* 1663

537.591.5 = 3 1599

Investigation of the 27-day period of cosmic radiation. GHERI, H., AND STEINMAURER, R. *Acta Phys. Austriaca*, **1** (*No.* 1) 42–54 (1947) *In German.*—The phase and amplitude of the 27-day period were studied using an ionization chamber shielded with 10 cm of Pb and 7 cm of Fe. The results are compared with the theoretical treatment by Vallarta (based on the inclination of the magnetic and rotational axes of the sun), and the effects of solar activity and variations of the earth's magnetic field are also examined. J. G. W.

537.591.8 = 3 1600

The second maximum of the Rossi-curve. OZORAI, Z. *Z. Phys.*, **122** (*Nos* 5–8) 413–17 (1944) *In German.*—Experiments were made to explain the second maximum of the Rossi-curve observed by Bothe and Schmeiser [Abstr. 2423 (1938)]. The secondary emission radiator was surrounded by 4 counters, and by a simultaneous counting circuit the direct beams and those leaving sideways could be determined. No maximum of the Rossi-curve was observable. Layers of wood, Pb, H_2O and coke were then placed between source and one counter in turn; and a maximum was observed with wood and H_2O. This was due to further secondary emission from the absorber layer, caused probably by a primary neutron-radiation. Experiments lend support to this explanation. V. W. R.

MAGNETISM 538

538 : 523.36 = 4 *see Abstr.* 1395

538.12 : 621.318.3 = 3 1601

Production of magnetic fields of high homogeneity by current systems. SAUTER, A., AND SAUTER, F. *Z. Phys.*, **122** (*Nos* 1–4) 120–36 (1944) *In German.*—The axial magnetic field due to circular currents and various t of coils is mathematically investigated and expresse series form. The conditions for greatest poss homogeneity of the magnetic field are deduced from series coefficients. Various current and coil systems discussed which give magnetic fields more homogene than that obtained with the Helmholtz arrangement. V. W

538.221 : 538.56 = 4 1

On the behaviour of a ferromagnetic wire grating in centimetre-wave band. EPELBOÏM, I. *J. Phys. Rac* (*Sér.* 8) **8**, 251–6 (*Aug.*, 1947) *In French.*—The ide complex permeability enables the theory of a Hert grating to be extended to include ferromagnetic mater Measurements on ferromagnetic gratings have enabl determination to be made of the variation of meability in the cm-wave region, which is confirmed other methods. The behaviour of ferromagnetic complicated by the heterogeneity due to the elemen domains, but modern experimental methods explain structure of the Weiss domains. G.

538.224 : 539.133 *see Abstr.* 1614

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

538.3 : 537.122 : 530.145 *see Abstr.* 1432

538.42 : 512.3 *see Abstr.* 1383

538.534 : 621.3.011.3 1

A general expression for the self-inductance o curvilinear wire. ZEITLIN, L. A. *C.R. Acad. URSS*, **54** (*No.* 1) 31–4 (1946).—A formula involvi double integral is obtained for the self-inductance, and this is split into 4 components. The determina of L is thus reduced to 2 independent problems. first has a solution which depends only on the equa of the axis of the wire, and is independent of the sh of the cross-section; the second is solved in the s manner for all wires whose cross-sections are of sim shape. L. S

538.56 = 3 1

A boundary value problem of the wave equation cylindrical co-ordinates. OBERHETTINGER, F. *Ann. Ph Lpz.* (*Folge* 5) **43** (*Nos* 1–2) 136–60 (1943) *In Germa* Deals with the effect on the resulting electric field tribution of metal sheets in the vicinity of a source electromagnetic radiation. The radiation field distri tion with an infinitely long metal cylinder is conside (*a*) with an oscillating elementary dipole parallel to cylinder axis and inside the cylinder, (*b*) with the di outside the cylinder. With (*a*) the current and f distribution can be represented by trigonometric cylindrical functions. With (*b*) the distribution is gi by means of integrals, and an approximate solutio given for the particular case of large dipole-cylin spacing. V. W

538.56 : 535.39 = 3 1

The reflection of e.m. waves at an inhomogeneous sh KOFINK, W. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1 119–33 (1947) *In German.*—A mathematical study various methods for the calculation of the reflec coefficient of a sheet whose permittivity is variable in direction, in particular of Epstein's method based on theory of analytical functions, and of Van Citt in which two simultaneous differential equations used for the incident and reflected wave. I

538.56 : 535.39 : 621.396.1 1

Metal optics at centimetre wavelengths. I. SPIERS

Mag., **39**, 105–16 (*Feb.*, 1948).—Reflection and mission coefficients are derived for a metal film ating two dielectric media. These are simplified by oximations, and special cases considered are (*a*) on a dielectric slab, (*b*) film on a dielectric slab ed by a perfect reflector, (*c*) resonance condition for onator loaded with a film on a dielectric slab. The ts apply to plane waves, but are also applicable to ed waves if certain conditions are satisfied. L. S. G.

6 : 538.221 = 4 *see Abstr.* 1602

66 : 535.421 *see Abstr.* 1522

66 : 621.396.11 : 551.510.535 *see Abstr.* 1718

66.3 : 535.515 : 621.396.11 = 3 1607

the theory of the double refraction of e.m. waves in nized gas under the influence of a constant magnetic (ionosphere). LASSEN, H. *Ann. Phys., Lpz.* (*Folge* 6) os 7–8) 415–28 (1947) *In German.*—Relations are between formulae established by different authors. form of the oscillations of the electric and magnetic s, and of the electronic orbits is also investigated.

L. P.

MAGNETIC EFFECTS 538.6

515 : 523.746 = 3 *see Abstr.* 1403–4

515 : 539.181 : 537.122 : 539.153 *see Abstr.* 1620

591 : 537.533.72 = 4 *see Abstr.* 1577

591 : 539.165.2 = 4 *see Abstr.* 1640

OMIC AND MOLECULAR STRUCTURE 539

11 : 535.375.5 : 548.7 = 4 *see Abstr.* 1703

13 : 535.375.5 = 3 *see Abstr.* 1514

13 : 537.226 *see Abstr.* 1544

132 1608

me applications of numerical analysis of normal tion frequencies of polyatomic molecules. MAJANTZ, *C.R. Acad. Sci. URSS*, **54** (*No.* 1) 27–9 (1946).—frequencies of characteristic vibrations for the CH_2–CH_2–C group of molecules of the type $C_{2n+1}Cl$ were computed for the *trans-*, *cis-* and gglied types of equilibrium configurations. The encies agreed well with those obtained from the bination scattering spectra, and it is suggested that characteristic frequencies may be used to determine configuration of molecules showing rotational nery. The frequencies in the YX_n groups are also ted to the angle between the bonds *Y–X*. The hod of least squares in searching for the best set of e constants is discussed. L. S. G.

132 1609

suggested new force field for molecular vibrations. TH, D. F., AND LINNETT, J. W. *Nature, Lond.*, **161**, -15 (*Feb.* 28, 1948).

132 : 535.343–15 = 4 *see Abstr.* 1496

132 : 535.343.3–15 = 4 *see Abstr.* 1498

132 : 535.375.5 = 4 *see Abstr.* 1515

132 : 536.46 1610

he dissociation of nitrogen in the welding arc. FAST, D. *Philips Res. Rep.*, **2**, 382–98 (*Oct.*, 1947).—For peratures of 5 000–10 000°K, the dissociation of N is puted on the basis of spectroscopic data, and for 3 erent values of the dissociation energy, namely 7·383, 73 and 9·764 eV; in view of a recent investigation by ydon and Penney [Abstr. 2240 (1945)] the highest ue is probably the correct one. At 10 000°K and a sure of 1 atm. the degree of dissociation is at least 99%; at 5 000°K 25·1% of the N will be dissociated if the energy = 7·383 eV, but only 1·63% will be dissociated if the energy is 9·764 eV. Two cruder methods of computation give results that differ only slightly from these "exact" values. A.

539.132 : 537.226 1611

On the theory of mechanical vibrations of macromolecules; their relation to radiospectra. JACOBSON, B. *Ark. Mat. Astr. Fys.*, **34A** (*Paper* 25) 9 *pp.* (1947).—Equations are derived for the frequencies of longitudinal, torsional and lateral vibration of rod-shaped cylindrical molecules, regarded as elastic bodies of uniform density. The frequencies for macromolecules lie in the region of those of radio waves and the possibility of investigating the vibrations of polar macromolecules by measurements of dielectric properties is discussed. L. A. W.

539.132 : 541.57 1612

Interaction terms in molecular vibrations. HEATH, D. F., AND LINNETT, J. W. *Nature, Lond.*, **161**, 243 (*Feb.* 14, 1948).—[See Abstr. 1018 (1948)]. The authors have reached similar conclusions, though differing in a few details.

539.133 : 537.228.5 : 535.343.4–14 *see Abstr.* 1502–3

539.133 : 537.533.73 1613

An electron diffraction investigation of formic acid monomer. SCHOMAKER, V., AND O'GORMAN, J. M. *J. Amer. Chem. Soc.*, **69**, 2638–44 (*Nov.*, 1947).—The technique of electron diffraction measurement has been modified by the use of a new heated nozzle through which the sample is introduced into the camera. The following parameter values are given: C : O = 1·213 ± 0·026 Å, C–O = 1·368 ± 0·034 Å, O . . . O = 2·275 ± 0·025 Å, angle O–C = O = 123·5 ± 3°, ratio C–O to C : O = 1·127 ± 0·018. W. R. A.

539.133 : 538.224 1614

A note on the polarizability and the diamagnetic susceptibility of the hydrogen molecule. STEENSHOLT, G. *Phil. Mag.*, **38**, 748–51 (*Oct.*, 1947).—The quantities mentioned are calculated with the aid of Coulson's self-consistent field eigenfunctions [Abstr. 2286 (1938)]. The results agree well with previous calculations. L. S. G.

539.152.1 1615

The deuteron problem with Gaussian potentials. MOSZKOWSKI, S., AND SACHS, R. G. *Phys. Rev.*, **73**, 184–5 (*Jan.* 15, 1948). **On the binding energy of the triton.** GOEPPERT-MAYER, M., AND SACHS, R. G. *Phys. Rev.*, **73**, 185 (*Jan.* 15, 1948).—A variational calculation has been made for a Gaussian neutron-proton potential including a tensor interaction. Both *S* and *D* wave functions were taken to be Gaussian functions. The resultant values of the various parameters are given. These results are then used to give information on the binding energy of the triton. The calculations were not carried through in full, but inspection reveals that the best wave function combines 96% *S* and 4% *D*, which gives a binding energy of 9·5 MeV. The effect on the binding energy of various types of forces is briefly discussed. W. E. D.

539.152.1 : 523.877 *see Abstr.* 1416

539.152.1 : 537.133 1616

The scattering of protons by deuterons. MASSEY, H. S. W., AND BUCKINGHAM, R. A. *Phys. Rev.*, **73**, 260–1 (*Feb.* 1, 1948).—By using a nucleon potential function of the form

$$V(r) = A(mM + hH + bMH + \omega)\varepsilon^{-2r/a},$$

where M and H are the Majorana and Heisenberg operators respectively, and by choosing appropriate

values of the constants to give, in the one instance, ordinary forces, and in the other, exchange forces, calculations show that the exchange force gives good agreement with experiment. W. E. D.

539.152.1 : 539.18 : 530.145 = 3 *see Abstr.* 1433

539.152.1 : 539.185 1617

Range of nuclear forces in the neutron-proton triplet interaction. SHULL, C. G., WOLLAN, E. O., MORTON, G. A., AND DAVIDSON, W. L. *Phys. Rev.*, **73**, 262 (*Feb.* 1, 1948).—From the coherent scattering of neutrons by H in a crystal and from total scattering cross-section by free protons the triplet and singlet scattering cross-sections can be calculated. Inserting these values into the expression given by Hamermesh and Schwinger [Abstr. 2251 (1947)], a value of $1{\cdot}2 \pm 0{\cdot}4 \times 10^{-13}$ cm is given for the range of the *n-p* triplet interaction which is < half the value assumed for the *p-p* singlet interaction. W. E. D.

539.152.2 = 5 1618

Experiments on nuclear induction. BOLLE, A., PUPPI, G., AND ZANOTELLI, G. *Nuovo Cim.*, **3**, 412–14 (*Dec.*, 1946) *In Italian.*—Nuclear induction is applied to the determination of the magnetic moment of the Li^7 nucleus by comparison with that of the proton. The result is: $\mu = 3{\cdot}22 \pm 0{\cdot}02$ nuclear magnetons. L. P.

539.152.2 = 5 1619

Some aspects of nuclear induction. GIULOTTO, L., GIGLI, A., AND SILLANO, P. *Nuovo Cim.*, **4**, 201–2 (*June*, 1947) *In Italian.*—A preliminary paper describing an apparatus for the study of this phenomenon. L. P.

539.152.2 = 5 1620

A new aspect of nuclear induction. GIULOTTO, L., AND GIGLI, A. *Nuovo Cim.*, **4**, 275–6 (*Oct.*, 1947).—*In Italian.*—The axis of the receiving coil is not exactly perpendicular to the two magnetic fields (it is rotated at an angle of 30″ about the constant field). The deformation of the signal observed on a c.r.o. is described and explained. L. P.

539.152.2 : 535.343.4–14 *see Abstr.* 1504

539.153 : 538.615 : 539.181 : 537.122 1621

On the intrinsic moment of the electron. FOLEY, H. M., AND KUSCH, P. *Phys. Rev.*, **73**, 412 (*Feb.* 15, 1948).—[See Abstr. 1030 (1948)]. The ratio of the g_J value of Na in the $^2S_{\frac{1}{2}}$ state to that of Ga in the $^2P_{\frac{1}{2}}$ state is found to be $3{\cdot}00732 \pm 0{\cdot}00018$. This can be explained by assuming $\delta_S - 2\delta_L = 0{\cdot}00244 \pm 0{\cdot}00006$ where $g_S = 2 + \delta_S$ and $g_L = 1 + \delta_L$. No confirmation of Breit's suggestion [Abstr. 691 (1948)] is given. W. E. D.

539.155.2 = 3 1622

Separation of the thallium isotope. I. Mass-spectroscopic separation. WALCHER, W. *Z. Phys.*, **122** (*Nos* 5–8) 401–6 (1944) *In German.*—The spectroscope described by Walcher [Abstr. 1763 (1938), 1582 (1948)] was used to separate Tl^{203} and Tl^{205}. After 20 hrs' operation, 25 μg of 97·5% Tl^{205} and 15 μg of 65% Tl^{203} was produced as a deposit on an Al foil target. The isotope yield was determined by target-current measurement with a rotatable disc with suitable aperture, calibrated by measurements with pure Bi^{209}. V. W. R.

539.155.2 : 535.338.332 = 3 1623

Separation of the thallium isotope. II. Spectral investigation of various Tl mixtures. KOPFERMANN, H., AND WALCHER, W. *Z. Phys.*, **122** (*Nos* 5–8) 465–70 (1944) *In German.*—To test the results of Tl isotope separation by Walcher [Abstr. 1622 (1948)], the hyperfine structure of the spectrum of the two isotope mixtures was investigated by a photographic blackening process. A special hollow cathode was used to give a sufficiently strong spectrum for an interferometer photograph w the small isotope quantities available. The % purity determined by this optical process is < that by the elect process in Abstr. 1622 (1948). This is due to the f that the electric method gives instantaneous values, wi the optical method yields the final values. V. W.

539.155.2 : 521.041 *see Abstr.* 1386

539.155.2 : 521.042 *see Abstr.* 1388

539.155.2 : 533.15.096 *see Abstr.* 1464

539.155.2 : 535.24 : 541.23 = 3 16

A new method of measuring the relative abundance isotopes. The isotope distribution and atomic weight hafnium. MATTAUCH, J., AND EWALD, H. *Z. Phys.*, 1 (*Nos* 5–8) 314–56 (1944) *In German.*—Describes photometric method of measuring the relative isotc abundance from the blackening of a photographic pla The plate was exposed to the mass-spectrum of element under test (Hf) and other calibrating eleme whose mass spectrum was accurately known from elect metric determinations (Os, Kr, Xe, Zn and Hg). Resu with Hf were

Mass	174	176	177	178	179	18
% abundance	0·18	5·3	18·47	27·10	13·84	35·

The method gives errors > than those with electromet methods, and is both quicker and more sensitive. V. W.

539.155.2 : 536.48 : 536.25 16

He^3 separation by a heat flux in liquid helium II. LA C. T., FAIRBANK, H. A., ALDRICH, L. T., AND NIER, A. *Phys. Rev.*, **73**, 256–7 (*Feb.* 1, 1948).—By making use the fact that He^4 in the superfluid phase flows against t heat flow in a temp. gradient while He^3 moves only w the heat flow, samples enriched in He^3 by as much 130× have been obtained. W. E.

539.155.2 : 537.534 = 3 *see Abstr.* 1582

539.155.2 : 539.163 16

Isotopic composition of samarium. INGHRAM, M. HESS, D. C., JR., AND HAYDEN, R. J. *Phys. Rev.*, **73**, 1 (*Jan.* 15, 1948).—New measurements, using electr metric recording of the ion currents. Sm^{146} is <0·002 and thus cannot be the origin of the present α-activi of Sm.

539.155.2 : 539.167.3 *see Abstr.* 1643

539.155.2 : 541.23 = 3 16

Photometric determination of rare isotopes. Relati isotope abundance and atomic weight of nickel. EWAL H. *Z. Phys.*, **122** (*Nos* 9–12) 686–96 (1944) *In German.* The photometric determination of relative isoto abundance by Mattauch and Ewald [Abstr. 1624 (194 is modified to enable accurate comparison betwe abundant and rare isotopes. A constant ion-source used, and the blackening curve of the photograp plate need not be known. The method is described detail and used to determine the relative abundance Ni isotopes.

Mass No.	58	60	61	62	6
% abundance	69·18	25·82	0·97	3·28	0·
Probable error	1%	2%	3%	2%	4

At. wt of Ni = $58{\cdot}66 \pm 0{\cdot}02$. V. W.

RADIOACTIVITY . NUCLEAR DISINTEGRATIC NUCLEAR PARTICLES 539.16/.18

539.16 : 535.6 : 548.0 = 3 *see Abstr.* 1698

539.16.08 16

Routine analysis of the alpha activity of protactiniu samples. BLAU, M., AND SINASON, H. *Science*, 1(

1. (*Oct.* 24, 1947).—Measurements are made of the ation occurring above a layer of material which is compared with the α-particle range. Calibration is ted by adding a known amount of Po to one sample, observing the ionization caused by those α-particles h escape. The use of thick samples is recommended use small contaminations of high specific activity are important than for thin samples. A. P. F.

16.08 1629

mparison of the determination of the disintegration of radiophosphorus by absolute beta counting and imetric measurement. ZUMWALT, L. R., CANNON, ., JENKS, G. H., PEACOCK, W. C., AND GUNNING, . *Science*, **107**, 47 (*Jan.* 9, 1948).—The disintegration determined by the calorimetric method, the use of a rated G–M tube, and the use of a standard RaD + E source all agree within experimental uncertainty. results indicate that, using thin, end-window G–M ter tubes with proper technique, the disintegration of P^{32} may be determined with a probable error of or 3%.

16.08 : 549.211 : 535.345 *see Abstr.* 1505

16.08 : 549.211 : 537.56 1630

e crystal counter. JENTSCHKE, W. *Phys. Rev.*, **73**, (*Jan.* 1, 1948).—The number of ions produced in mond crystal counters was found to be of the same r as in ordinary ionization chambers. To explain occasional high energy pulses it is suggested that , at least, are due to sudden discharge of the space ge. W. E. D.

63 : 539.155.2 *see Abstr.* 1626

163.2 1631

ote on gamma-radiation from europium. CORK, J. M., FFLER, R. G., AND FOWLER, C. M. *Phys. Rev.*, **73**, *Jan.* 1, 1948).—The agreement between the energy rence of two of the lines and the *K–L* difference of ent 61 is purely fortuitous.

63.2 1632

e radiations from 2·70-day Au^{198}. LEVY, P. W., AND ULING, E. *Phys. Rev.*, **73**, 83–4 (*Jan.* 1, 1948).— β-components of max. energies 0·970 ± 0·010 MeV ·605 ± 0·014 MeV were found, and a decay scheme ggested. W. E. D.

63.2 1633

e beta- and gamma-spectra of Ga^{72}. HAYNES, S. K. *Rev.*, **73**, 187–8 (*Jan.* 15, 1948).—A table of β- and energies and intensities, measured with a thin-lens rometer, is given and a partial decay scheme is osed. W. E. D.

63.2 1634

e ratio of positives to negatives in Cu^{64}. CRANBERG, ND HALPERN, J. *Phys. Rev.*, **73**, 259–60 (*Feb.* 1, .—The effect of scattering in the source is discussed lation to the disagreement with theory of the ratio mined at low energies [Abstr. 545 (1946)]. W. E. D.

63.2 1635

e disintegration scheme of Cs^{134}. SIEGBAHN, K., AND TSCH, M. *Phys. Rev.*, **73**, 410 (*Feb.* 15, 1948).— disintegration scheme proposed by Elliott and Bell tr. 723 (1948)] is experimentally confirmed in every ct. W. E. D.

63.2 1636

nge and energy of beta-radiation from calcium 45. MON, A. K., AND GLENDENIN, L. E. *Phys. Rev.*, **73**, 16 (*Feb.* 15, 1948).—The only β-ray found in this ity had an energy of 260 ± 5 keV, range 64 ± m² of Al [see Abstr. 1096 (1940)]. W. E. D.

539.163.2 1637

Beta-rays and gamma-rays from arsenic (76). SCHERB, M. V., AND MANDEVILLE, C. E. *Phys. Rev.*, **73**, 418–19 (*Feb.* 15, 1948).—β-rays of 2·76 MeV energy were shown to lead to the ground state of Se^{76} residual nucleus. Three γ-rays of 0·94, 2·16 and 2·76 MeV energy were found, and coincidence measurements confirmed the term diagram proposed by Siegbahn [Abstr. 2217 (1947)]. W. E. D.

539.163.4 : 545.844 = 3 *see Abstr.* 1695

539.164.08 : 778.34 = 4 1638

Calibration of a new photographic plate for measuring paths of α-particles. TSIEN, S.-T., CHASTEL, R., FARAGGI, H., AND VIGNERON, L. *C.R. Acad. Sci., Paris*, **223**, 571–3 (*Oct.* 14, 1946) *In French.*—The half-tone concentrated plate of Ilford, Ltd., was used, the source of α-particles being $B^{10}(n,\alpha)Li^7$. Two methods for calibrating the plate are described. The accuracy $\simeq 1\%$ and the resolving power $\simeq 3$ mm of air (~ 300 keV). L. S. G.

539.165 : 535.371 *see Abstr.* 1510

539.165.2 = 4 1639

On the possible existence of a particular type of radioactivity: the phenomenon of *e*-creation. DAUDEL, R., JEAN, M., AND LECOIN, M. *J. Phys. Radium* (*Sér.* 8) **8**, 238–43 (*Aug.*, 1947) *In French.*—See Abstr. 2970 (1947), 732 (1948). After a general outline of the problem, the probability of *K*-creation relative to normal β^--emission is evaluated as a function of Z and the disintegration energy. A. P. F.

539.165.2 : 530.12 : 530.145 = 4 *see Abstr.* 1430

539.165.2 : 538.691 = 4 1640

Behaviour of a particle with very small charge and with a magnetic moment. THIBAUD, J. *C.R. Acad. Sci., Paris*, **225**, 999–1001 (*Nov.* 24, 1947) *In French.*—The behaviour of a neutrino resulting from the assumption of a very small charge is discussed. By virtue of the small rest-mass, the magnetic moment $\mu = seh/2\pi m_0$ will be relatively very large. For $m_0 \simeq 10^{-39}$ gm, μ/e will be near unity, and the purely magnetic force on the particle in a strongly non-uniform magnetic field would be important compared with the ordinary force, even at velocities approaching c. The trajectories in a non-uniform field disposed as in the paper of Abstr. 1577 (1948) resulting from the effects of this purely magnetic force are investigated. J. H. F.

539.166 : 537.122 1641

Low energy pair production. HOUGH, P. V. C. *Phys. Rev.*, **73**, 266–7 (*Feb.* 1, 1948).—Approximate expressions are given for the differential cross-section, and a selection of values calculated from them is compared with the exact Bethe–Heitler formula [Abstr. 3411 (1934)]. W. E. D.

539.166 : 539.174 *see Abstr.* 1658

539.167.3 1642

Radioactive carbon of high specific activity. NORRIS, L. D., AND SNELL, A. H. *Phys. Rev.*, **73**, 254–5 (*Feb.* 1, 1948).—Some $BaC^{14}O_3$ samples with isotopic concentration of 19–27% have been prepared. W. E. D.

539.167.3 : 539.155.2 1643

Some isotopes of platinum and gold. WILKINSON, G. *Phys. Rev.*, **73**, 252–3 (*Feb.* 1, 1948).—By bombarding Ir with He ions, deuterons, fast and thermal neutrons and Au with fast neutrons several activities identified with the light isotopes of Pt and Au were detected. A table is given showing the isotopic assignment, ½-life and energy of the emitted particle and of any γ-rays, and the probable mode of formation of the 2 Pt and 7 Au activities. W. E. D.

539.167.3 : 545.8 = 3 *see Abstr.* 1694

539.17 : 544.1 = 3 *see Abstr.* 1692

539.172 1644

Excitation function of the reaction $C^{12}(p,pn)C^{11}$ at high energies. HECKROTTE, W., AND WOLFF, P. *Phys. Rev.*, **73**, 264–5 (*Feb.* 1, 1948). **Excitation function of the reaction $C^{12}(n,2n)C^{11}$ at high energies.** *Phys. Rev.*, **73**, 265–6 (*Feb.* 1, 1948).—Excitation curves are calculated for these two reactions using a pure *n-p* exchange force, and one which is half exchange and half ordinary. In the first reaction both theoretical curves rise to a max. at a proton energy of ~40 MeV after which there is a drop and then a steady rise, whereas the experimental curve has no max. and rises to a constant value at ~60 MeV [Abstr. 741 (1948)]. The corresponding curves for the $(n,2n)$ reaction are also not in very close agreement with experiment. The ratio of the cross-section for the (p,pn) reaction to that for the $(n,2n)$ fits the experimental results more closely if the mixed interaction is assumed. W. E. D.

539.172 1645

The electro-disintegration of Cu^{63}, Ag^{107}, and Ag^{109}. SKAGGS, L. S., LAUGHLIN, J. S., HANSON, A. O., AND ORLIN, J. J. *Phys. Rev.*, **73**, 420 (*Feb.* 15, 1948).—Cross-sections are given for these processes, measured for electrons of 13, 16 and 17·5 MeV from a 22-MeV betatron. W. E. D.

539.172 : 539.18 1646

A nuclear evaporation recorded in an emulsion near sea level. YAGODA, H. *Phys. Rev.*, **73**, 263–4 (*Feb.* 1, 1948).—A nuclear explosion in a photographic emulsion at sea level shows one α-track and 5 proton tracks. If 5 neutrons were also emitted with the same total energy as that of the protons then the event would be consistent with the explosion of N^{14} by the entry of a heavy meson ($\sim 300\, m_e$). W. E. D.

539.172 : 539.18 *see Abstr.* 1664

539.172.11 1647

Excitation curves of (α,n); $(\alpha,2n)$; $(\alpha,3n)$ reactions on silver. GHOSHAL, S. N. *Phys. Rev.*, **73**, 417–18 (*Feb.* 15, 1948).

539.172.13 1648

Absolute cross section for the reaction $C^{12}(p,pn)C^{11}$ at high energy. MCMILLAN, E. M., AND MILLER, R. D. *Phys. Rev.*, **73**, 80–1 (*Jan.* 1, 1948).—The cross-section for the process with bombarding protons at ~60 MeV was found to be $0{\cdot}073 \pm 0{\cdot}010$ barn (10^{-24} cm^2). It is independent of energy up to at least 140 MeV. Production of C^{11} from C, N and O is in the ratio 1 : 0·28 : 0·36. W. E. D.

539.172.4 1649

Attempts to detect the emission of secondary charged particles in the fission of ^{235}U by slow neutrons. CASSELS, J. M., DAINTY, J., FEATHER, N., AND GREEN, L. L. *Proc. Roy. Soc. A*, **191**, 428–41 (*Dec.* 3, 1947).—A search was made for coincidences between fission fragments and secondary particles, short-range and long-range particles being studied separately. Small positive effects were found in both cases, the results being reconcilable with later investigations on this subject [Abstr. 747 (1948)]. A. P. F.

539.172.4 1650

The disintegration energy of $N^{14}(n,p)C^{14}$. HUBER, P., AND STEBLER, A. *Phys. Rev.*, **73**, 85 (*Jan.* 1, 1948).—The energy of this reaction was measured with an ionization chamber to be $0{\cdot}63 \pm 0{\cdot}01$ MeV, taking a recent value of the ionization energy of N^{14} [Abstr. 3564 (1947)]. Refs. are given to earlier measurements. W. E. D.

539.172.4 1

(n,p) and (n,α) disintegrations of nitrogen by neutrons. HUBER, P., AND STEBLER, A. *Phys. Rev.*, 89–90 (*Jan.* 1, 1948).—Curves and tables (the la including earlier work) are given showing 4α an proton resonances in these two processes, and an en level scheme is proposed for N^{15}. W. E

539.172.4 1

Cross section for the reaction $C^{12}(n,2n)C^{11}$ at 90 M MCMILLAN, E. M., AND YORK, H. F. *Phys. Rev.*, 262–3 (*Feb.* 1, 1948).—The cross-section is found to $0{\cdot}022 \pm 0{\cdot}004 \times 10^{-24}$ cm^2 being in the ratio of ~1 3·3 to the cross-section for the corresponding $(p$ reaction. W. E

539.172.4 = 397 1

The energy of atomic fragments from fission of uran nuclei by slow and fast neutrons. SIMONS, L. *Fin Kemistsamfundets Medd.* (*Nos* 3–4) 1–7 (1946) *In Swed* —A report on measurements [Abstr. 1657 (1948)] un taken to ascertain the statistical energy distributi The Bohr–Wheeler theory is outlined and an ene distribution curve is given. Both for slow and fast to 14 MeV) neutrons, the distribution seems to be in mass ratio 60 : 85 ≃ 2 : 3, but the distribution curve r be smoothed for fast neutrons. Slow neutrons split rare 235 isotope, fast neutrons mainly the 238 isot Further, more accurate, experiments with photograp recording are in progress. J. A.

539.172.4 = 4 1

On the fission of uranium into three fragments, produ by neutron capture. TSIEN, S.-T., CHASTEL, R., Z.-W., AND VIGNERON, L. *C.R. Acad. Sci., Paris*, 986–7 (*Dec.* 9, 1946) *In French.*—An Ilford half-t concentrated plate [Abstr. 1638 (1948)] was impregna with a 20% solution of U nitrate, and was exposed slow neutrons obtained from a cyclotron. After devel ment the photographs obtained led to these results one case the masses and energies (in MeV) of th fragments were 120, 59; 110, 63; 5 ± 1, 20, the t energy being ~142 MeV; in the next case the res were 150, 67; 76, 131; 9 ± 3, 4; and in the third, 93, 137, 49 and 5, 75. L. S

539.172.4 = 4

Experimental demonstration of the fission of uran into four fragments. HO, Z.-W., TSIEN, S.-T., VIGNER L., AND CHASTEL, R. *C.R. Acad. Sci., Paris*, **223**, 111 (*Dec.* 23, 1946) *In French.*—In one of a series of ph graphs taken previously [Abstr. 1654 (1948)], there o 4 trajectories approx. in a plane. The photograp reproduced and the lengths of, and angle between, trajectories are shown. From these results, assu fission of U^{236} takes place without emission of a neut there is an infinity of possible values M_1, M_2, M_3 M_4 for the masses of the 4 fragments. Some exam are given, from which it appears that M_1 and M_2 practically constant, while M_3 and M_4 are also ne constant. The energies are also calculated. L. S

539.172.4 = 3

The relative yields of some $(n,2n)$-processes. JEN P. *Z. Phys.*, **122** (*Nos* 5–8) 387–400 (1944) *In Germa* The relative β-yields of the $(n,2n)$ processes leadin C^{11}, N^{13}, O^{15}, F^{18}, Cu^{62}, Ag^{106} and Sb^{120} were meas and compared with the values found by Bothe Gentner [Abstr. 2029 (1939)]. The results are sin except for the lighter nuclei. The relations between $(n,2n)$ capture cross-section and the primary neu energy were found experimentally, and are smaller those given in the theoretical formula by Weisskopf

ing [Abstr. 1507 (1940)]. The $(n,2n)$ cross-sections of vy nuclei approach πr^2, the geometrical cross-tion, with primary neutron energy of ~ 16 MeV.
V. W. R.

.172.4 : 539.185 = 3 *see Abstr.* 1670

.172.4 : 545.844 *see Abstr.* 1696

.172.4 : 545.844 = 3 *see Abstr.* 1697

.172.4.08 1657
n apparatus for measuring the energies of fission gments obtained by slow and fast neutron bombardment. ONS, L., AND GROTENFELT, B. *Comment. Phys. Math., singf.*, **13** (*No.* 9) 9 *pp.* (1947).—The parallel-plate ization chamber was filled with A at 2 atmos. and erated at 1 kV supplied by a miniature cascade erator. Impulses were amplified by a 5-stage amplifier recorded by a c.r.o. Details and diagrams are given, cedure and precautions discussed. J. A. W.

.174 : 539.166 1658
Gamma-radiation from light nuclei under proton bardment. FOWLER, W. A., LAURITSEN, C. C., AND RITSEN, T. *Phys. Rev.*, **73**, 181–2 (*Jan.* 15, 1948).—γ-rays emitted at resonance when Li, Be, C and F bombarded by protons are studied. A table is given, uding earlier work, showing the energy of the radia-, the energy of the secondary electrons produced in the thick target yield as measured both by counter and troscope methods, the resonance ½-width and the ss-section for the process. W. E. D.

.18 1659
earch for gamma-radiation in the 2·2-microsecond on decay process. HINCKS, E. P., AND PONTECORVO, *Phys. Rev.*, **73**, 257–8 (*Feb.* 1, 1948).—No γ-ray was nd to accompany meson decay. W. E. D.

.18 : 535.1 : 530.145 = 3 1660
On the production of mesons by light quanta with a ger theory. URBAN, P. *Acta Phys. Austriaca*, **1** (*No.* 2) 77 (1947) *In German.*—The total cross-section is ulated for the production of scalar mesons as a tion of the energy E_0 of the incident quantum. The ting value for high energies $E_0 \gg \mu c^2$ is distinct from es obtained earlier, as it includes an extra term ch is logarithmic in E_0, which is $\gg$ the remaining terms iously derived. G. J. K.

.18 : 537.591 1661
he mean life of negative mesotrons in sodium fluoride. HO, H. K., AND SCHEIN, M. *Phys. Rev.*, **73**, 81–2 r. 1, 1948).—By separate measurements on negative positive mesons, separated by a magnetized Fe ts" [Abstr. 1313 (1947)] and using NaF as absorber, mean life of the negatives was found to be $1{\cdot}33 \pm$ μsec and that of the positives $2{\cdot}1 \pm 0{\cdot}3$ μsec. W. E. D.

.18 : 537.591 = 3 1662
n the creation and annihilation of mesons by interaction matter. URBAN, P. *Acta Phys. Austriaca*, **1** (*No.* 1) 73 (1947) *In German.*—The cross-section for the tion of vector mesons is recalculated by perturbation ry with an interaction term involving the meson, tons and the heavy particles. Although the prob-ty of production is considerably increased, the agree-t with experimental values is not much better for the of production of mesons to electron-pairs at sea), with usual values for the mass and interaction tants. G. J. K.

.18 : 537.591.15 *see Abstr.* 1596

.18 : 537.591.2 = 3 *see Abstr.* 1597

.18 : 537.591.2 = 4 *see Abstr.* 1598

539.18 : 537.591.3 1663
On the mean life of negative mesons. VALLEY, G. E., AND ROSSI, B. *Phys. Rev.*, **73**, 177–8 (*Jan.* 15, 1948).—The mean lives of positive and negative mesons in Al were measured [see Abstr. 419 (1948)] and found to be $2{\cdot}19 \pm 0{\cdot}24$ and $0{\cdot}74 \pm 0{\cdot}17$ μsec respectively. The eventual fate of negative mesons is considered, and the authors discuss the hypothesis that negative mesons are never captured by nuclei but that their natural life-time is shortened when they are close to a nucleus. W. E. D.

539.18 : 539.152.1 : 530.145 = 3 *see Abstr.* 1433

539.18 : 539.172 1664
On the capture of negative mesons. PICCIONI, O. *Phys. Rev.*, **73**, 411 (*Feb.* 15, 1948).—Both the cloud chamber and counter experiments have failed to detect any event following the nuclear capture of a negative meson, and the explanation of this is discussed. Valley and Rossi's suggestion [Abstr. 1663 (1948)] is criticized. W. E. D.

539.18 : 539.172 *see Abstr.* 1646

539.181 : 537.122 : 538.615 : 539.153 *see Abstr.* 1620

539.185 1665
Scattering of neutrons by lead. LATHAM, R., AND CASSELS, J. M. *Nature, Lond.*, **161**, 282–3 (*Feb.* 21, 1948).—The cross-section drops to $0{\cdot}6 \pm 0{\cdot}3 \times 10^{-24}$ cm^2 for neutron wavelengths > 6 Å, which is an upper limit for the residual scattering caused by the presence of several Pb isotopes. This gives a value of $\sim 10 \times 10^{-24}$ cm^2 for the coherent scattering cross-section relevant in single crystal diffraction, which disagrees with Fermi and Marshall [Abstr. 2250 (1947)].

539.185 = 3 1666
The space-distribution of retarded neutrons. BOTHE, W. *Z. Phys.*, **122** (*Nos* 9–12) 648–59 (1944) *In German.*—Gives and investigates expressions for the spatial distribution of neutrons in an isotropically scattering medium (moderator) when subjected to a given number of collisions. The method used is similar to that for calculating the angular scattering of rays of small particles passing through foils, given by Bothe [Abstr. 433 (1922)]. The results are applied to the slowing-down process of neutrons in moderators. V. W. R.

539.185 = 3 1667
Slowing down of neutrons in carbon, water and heavy water. JENSEN, P. *Z. Phys.*, **122** (*Nos* 9–12) 756–68 (1944) *In German.*—The mean diffusion lengths and capture cross-section of C, H_2O and D_2O were measured with various neutron sources. Using these values, it is shown how to calculate the diffusion length and capture cross-section of all materials composed of H, D, C, and O, and the theoretical values are in approx. agreement with measurements. For neutrons of energies from 2·7 MeV to 0·9 eV the following mean effective cross-sections were found: H, 5·27; D, 1·77; C, 2·72; O, $2{\cdot}2 \times 10^{-24}$ cm^2; they are used as basis for the calculation. V. W. R.

539.185 = 3 1668
Mean free path of neutrons in carbon and heavy water. WIRTZ, K. *Naturwiss.*, **33**, 366 (*Dec.* 30, 1946) *In German.*—The mean free path of slow neutrons of energies 0·9 and 0·04 eV were found to be 46·2 and 49·3 cm respectively in C and 30 and 31 cm in D_2O. G. J. K.

539.185 : 535.51 1669
On the polarization of fast neutrons. SCHWINGER, J. *Phys. Rev.*, **73**, 407–9 (*Feb.* 15, 1948).—Theory shows that complete polarization is to be expected for 1-MeV

neutrons at a scattering angle of 1·5°; 80% polarization at 3°, 47% at 6° and 32% at 9°. W. E. D.

539.185 : 539.152.1 *see Abstr.* 1617

539.185 : 539.172.4 = 3 1670

Interaction of neutrons and γ-rays with beryllium. FÜNFER, E., AND BOTHE, W. *Z. Phys*, **122** (*Nos* 9–12) 769–77 (1944) *In German.*—The diffusion length and capture cross-section of thermal neutrons, Raα + Be and Raα + F neutrons, and photo-neutrons from Ra γ-rays on Be were measured. With Raα + Be neutrons, the effective cross-section of the $Be^9(n,2n)$ process is at least 3× that of the (n,α) process. No definite difference between the $(n,2n)$ and (n,α) cross-sections was found with Raα + F neutrons. The diffusion length of thermal neutrons in Be > 25 g/cm² and the capture cross-section of the Be^9 nucleus < 16×10^{-27} cm². V. W. R.

539.185.08 1671

Measurements of neutron intensities by means of a boron-lined ionization chamber. VON UBISCH, H. *Ark. Mat. Astr. Fys.*, **35A** (*Paper* 11) 9 *pp.* (1947).—The design and operation of a neutron monitor of high sensitivity for use with a cyclotron are described. A. P. F.

539.185.7 = 3 1672

The absorption of thermal neutrons in carbon. BOTHE, W., AND JENSEN, P. *Z. Phys.*, **122** (*Nos* 9–12) 749–55 (1944) *In German.*—The diffusion length and capture cross-section of thermal neutrons in electrographite was measured and the experimental set-up and results are described. By determining the absorption of ash separately, the values for pure C are deduced. The values found are: capture cross-section = $(6{\cdot}4\pm1)\times10^{-27}$ cm²; diffusion length = (67 ± 4)g/cm². V. W. R.

STRUCTURE OF SOLIDS 539.2

539.215 1673

An electron microscopic study of the ageing of smoke deposits. ROGINSKY, S. Z., SHEKHTER, A. B., AND SAKHAROVA, S. V. *C.R. Acad. Sci. URSS*, **52** (*No.* 8) 687–9 (1946).—Smoke deposits of Au and Ag, before and after heating, were examined. In the early stages of ageing of Au there was a differentiation of particles according to dimensions: the number of biggest and smallest particles increased, and the distribution according to dimensions expanded, the middle part being decreased. Ag ages more easily than Au, but smoke deposits of ZnO and MgO withstand much higher temperatures without change. L. S. G.

539.215.2 : 539.434 1674

On the structure of grain boundaries in metals. KÊ, T.-S. *Phys. Rev.*, **73**, 267–8 (*Feb.* 1, 1948).—The activation energies calculated from volume diffusion, creep and grain boundary slip are in reasonable agreement for α-brass, α-Fe and Al. This suggests that grain boundary slip can be considered as a microscopic creep. W. E. D.

539.215.4 : 531.717 *see Abstr.* 1442

539.217.3 : 621.317.39 : 533.275 *see Abstr.* 1465

539.232 : 548.5 1675

On the amorphous and crystalline oxide layer of aluminium. DEKKER, A. J., AND VAN GEEL, W. C. *Philips Res. Rep.*, **2**, 313–19 (*Aug.*, 1947).—Al can be covered electrolytically with a porous layer of Al_2O_3, and oxidation afterwards in H_3BO_3 gives rise to the formation of a crystalline layer. The experiments show that this layer only fills up the holes of the amorphous Al_2O_3. There is a correlation between the current density oxalic acid and the porosity of the amorphous layer th formed.

539.234 : 537.311.33 *see Abstr.* 1548

539.234 : 537.533.73 = 3 16

The lattice constants of evaporated aluminium laye KÖNIG, H. *Naturwiss.*, **33**, 367–8 (*Dec.* 30, 1946) *German.*—Al is unsatisfactory as a reference substance electron diffraction since its lattice constant is affected its method of preparation. An evaporated Al lay prepared in the usual way by use of a W spiral show smaller lattice constant than would be expected, and t is attributed to the solution of up to 3% of W in the On the other hand, tempering of an Al layer in order increase the sharpness of the diffraction rings results an increase of lattice constant, which is attributed to take-up of O by the outermost net-planes of the specim J.

539.234 : 539.26 : 535.39 1

Structure of calcium fluoride films evaporated polished glass surfaces. BANNON, J., AND CURNOW, C. *Nature, Lond.*, **161**, 136–7 (*Jan.* 24, 1948).—X-ray diffraction studies confirmed the influence of the gl temperature on the structure of the CaF_2 layer [Abs 1296 (1946)]. For $\frac{1}{2}\lambda_{5500}$ films deposited at 25°C, (111) planes of the crystallites were not appreciab orientated, and orientation was complete for 10 deposition, approx. parallel to the glass and perpendicu to the fibres of which the film appeared to be construct

539.26 : 535.39 : 539.234 *see Abstr.* 1677

539.26 : 539.374 1

X-ray diffraction rings from deformed solid metal a metal powders. WOOD, W. A., AND RACHINGER, W. *Nature, Lond.*, **161**, 93–4 (*Jan.* 17, 1948).—Direct co parison of the breadth and intensity of the rings fr plastically deformed solid metal, and metal filings, usu taken to be equivalent, shows that they are not so; latter are considerably broader. An explanation, ba on the random orientation of the deformed lattices of powder, is given.

539.262 : 548.718 : 548.733 *see Abstr.* 1706

ELASTICITY . STRENGTH . RHEOLOGY 539.3

539.32 : 549.514.51 : 537.228.1 *see Abstr.* 1546

539.374 = 82 1

Elementary deformations of plastic-elastic bod GUBANOV, A. J. *J. Tech. Phys., USSR*, **17** (*No.* 4) 475 (1947) *In Russian.*—A study is made of the fami elementary shear, twisting and tensile deformatic generalized for the case of plastic-elastic bodies, consi ing that the plastic-elastic characteristics of bo appear only in the oscillating and non-stationary st whilst in the stationary state plastic-elastic bodies beh simply as plastic bodies. The non-stationary syster investigated, where starting from the moment $t = 0$ stress is applied to the body, as a function of time. operational method is applied to the solution, as in author's previous work [*J. Tech. Phys., USSR*, **16** (*N* (1946)]. Laplace transformations are applied for e equation and limiting condition, to a factor of ε with integration for t from 0 to ∞. Results obtained shear can be applied almost unmodified to the cas distortion of a cylinder. Torque and extensibility directly related to the mechanical treatment of pla and glass. Characteristics of the formulae are ded for simple and compound stresses.— R

374 : 531.19 1680

atistical theory of the elementary process of plastic rmation. LYONS, W. J. *Phys. Rev.*, **73**, 413–14 15, 1948).—A statistical framework is proposed which a more detailed theory may be built. Two ral assumptions are made concerning the prob-ty of rate of dislocation in terms of the force acting the area concerned with such a jump. W. E. D.

374 : 539.26 *see Abstr.* 1678

374 : 548.0 = 3 *see Abstr.* 1700

389.3 1681

astic relaxation and some other properties of the solid ions of carbon and nitrogen in iron. DIJKSTRA, L. J. *ps Res. Rep.*, **2**, 357–81 (*Oct.*, 1947).—The theory of ic relaxation in α-Fe caused by C and N in solid tion [Abstr. 2374 (1946)] predicts a strong anisotropy the various crystal directions. This theoretical lusion has been confirmed in a series of experiments ted out on prepared single crystals of Fe in the]- and [111]-directions. The theoretical absolute nitude of the effect was checked for C. The question ne most probable place of the dissolved particles in Fe lattice is discussed. At 20°c the rate of segregation g place in the form of a carbide or nitride was rmined by measuring the decrease in magnitude of lastic relaxation in the course of time. A.

4.011.22 1682

new criterion of yielding in metals due to complex ses. SWAINGER, K. H. *Phil. Mag.*, **39**, 122–33 (*Feb.*,).—When metal yields under an applied shear stress tension the curve obtained by plotting these stresses ariables is an ellipse. The equation of this ellipse is ten in vector form, and it is shown that any plane s system except 2-dimensional hydrostatic pressure nsion reduces to a simple shear and tension or com-sion at any point. A 3-dimensional system is reduc-to a simple tension or compression, together with two shears at any point, these 3 stresses defining 2 ellipsoidal surfaces for the complete specification of yielding. If the metal is isotropic, surfaces of revolution are obtained; then tests with simple shear and tension apply as the yield criterion. L. S. G.

539.42 : 539.431 *see Abstr.* 1683

539.431 : 539.42 1683

On the relation of the strength of materials to the stressing time. KONTOROVA, T. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 1) 23–6 (1946).—A theory of the fatigue in materials under steady repeated loading is given. It is assumed that a crack develops and the growth of the crack is accompanied by an increase in the stress per unit area of the cross-section of the test object. Eventually the stress reaches a definite critical value at which the material is suddenly ruptured. The relation between the critical stress and the time of its application is connected with the rate of growth of the crack. The latter is calculated. L. S. G.

539.434 = 82 1684

Variability of the stressed state of materials in time. RZHANITSYN, A. R. *J. Tech. Phys., USSR*, **17** (*No.* 4) 491–6 (1947) *In Russian.*—A study is made of the behaviour of bodies displaying creep characteristics, from the standpoint of arbitrary representation of the structure, for a non-uniform substance, formed from a solid framework and a viscous substance occupying the pores of the main structure. In contrast to the usual representation of absolute elasticity of the solid framework, providing a linear relationship between stresses and deformations, and clarifying only the reversible processes, the solid substance of the body takes on properties characteristic of non-elastic bodies. Consequently, several well-known facts concerning the behaviour of plastic-elastic bodies under alternating stresses can be simply interpreted. A graphical solution of the problem is given. R. M.

539.434 : 539.215.2 *see Abstr.* 1674

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

123.3 : 669 1685

he effect of manganese, iron and nickel on the α/β s equilibrium. HUME-ROTHERY, W. *Phil. Mag.*, **39**, 7 (*Feb.*, 1948).—The forms of the $\alpha/(\alpha+\beta)$ and $\alpha-\beta)/\beta$ isothermal phase boundaries are discussed for ternary systems Cu–Al–Zn, Cu–Al–X and Cu–Zn–X, re X is a transition element. In the systems Cu–Al– and Cu–Zn–Mn, the first additions of Mn affect the $+\beta)$ and $(\alpha+\beta)/\beta$ boundaries in the way to be cted if the α/β equilibrium were determined by tron concentration, and Mn behaved as a divalent ent. The passage Mn → Fe → Ni is accompanied continual decrease in the apparent valency of the sition element. L. S. G.

REACTION KINETICS 541.124./128

126 = 3 1686

ontribution to the theory of explosive gas reactions. MÜFFLING, L. *Z. Phys.*, **122** (*Nos* 9–12) 787–806 4) *In German.*—Deals with the time characteristics of hermal chain explosions with chain disintegrations of 1st and 2nd order, and those of 1st and 2nd order ltaneously. The variation of the propagation-ability with progressive consumption of the original rial is taken into account. The time characteristics of 1st and 2nd order chain disintegrations do not differ very greatly, but the velocity of reaction is found to have an asymmetrical variation with time, which corresponds with experimental results. V. W. R.

541.126 : 534.222.2 1687

Spread of detonation in high explosives. JONES, E., AND MITCHELL, D. *Nature, Lond.*, **161**, 98–9 (*Jan.* 17, 1948).—Two rates of detonation [Abstr. 2673 (1947)] are demonstrated by photographs in granular solid explosives. It is possible under certain circumstances for either rate to be propagated stably, which rate being determined by the form of detonation. The low rate appears to be characterized by incomplete decomposition of the explosive.

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18.041.2 1688

Quantitative treatment of a density distribution pattern on photographic paper as produced by the disturbance of a spotlight galvanometer. BEALL, G. *Paper Tr. J.*, **124**, *TAPPI Sect.*, 203–5 (*May* 8, 1947).—The nature and progress of the sedimentation of a dilute suspension of wood pulp in water, in a glass cylinder, may be ascertained by placing the cylinder between a source of light and a photo-electric cell connected to a moving spot galvanometer, the beam from which falls on a moving

strip of photosensitive paper. According as the suspended pulp is homogeneous or flocculent, so the galvanometer swing is small or large, and the density distribution band after development of the paper is narrow or broad, respectively. The results are evaluated statistically in terms of the standard deviation (*D*), which may be used to measure the degree of spread of the bands. Measurements of the intensities of the bands and of *D* are tabulated for different pulps. Variations in the flocculating properties of the same pulp, in duplicate experiments, are recorded. J. G.

541.182.6 : 535.51 : 535.434 = 4 *see Abstr.* 1526

ADSORPTION 541.183

541.183 : 532.516 1689

A tribometric method of measuring adsorption on a solid-solution interface. Applications to the study of the lubricating action of adsorbed layers. DERJAGUIN, B., AND SMOLIANSKY, M. *C.R. Acad. Sci. URSS*, **54** (*No.* 2) 137–40 (1946).—The main difficulty in measuring the adsorption is due to the small change in volume concentration by which the adsorption is gauged. This was overcome by reducing the volume of solution from which adsorption takes place. The method for doing this is described and results of measurements of the adsorption for the fatty acids and the alcohols are given graphically. L. S. G.

541.183 : 548.0 : 537.533 = 3 *see Abstr.* 1576

ATOMIC THEORY 541.2

541.23 : 535.24 : 539.155.2 = 3 *see Abstr.* 1624

541.23 : 539.155.2 = 3 *see Abstr.* 1627

541.265 : 536.655 *see Abstr.* 1540

CHEMICAL STRUCTURE 541.4/.6

541.57 = 4 1690

Recent developments in the theory of the reactivity of molecules possessing conjugated double bonds. COULSON, C. A., AND LONGUET-HIGGINS, H. C. *Rev. Sci., Paris*, **85**, 929–37 (*Sept.* 1 *and* 15, 1947) *In French.*

541.57 : 539.132 *see Abstr.* 1612

CHEMICAL APPARATUS 542.1/.7

542.48 : 536.423 = 3 1691

Reflux condensation of vapour mixtures of any number of components. FISCHER, V. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 139–52 (1947) *In German.*—Equations are given for the calculation of the concentrations of vapour and liquid in a reflux condenser. Their application is illustrated by the example of Claude's "retour en arrière" method for the initial separation of air. Further, the example of a reflux condenser for the separation of a mixture of CH_4, CO, N_2 and H_2 is given. In addition a general differential equation of rectification is derived, from which various special cases of condensation and rectification are deduced. H. L.

CHEMICAL ANALYSIS 543/545

544.1 : 539.17 = 3 1692

The chemical separation of the elements originating in uranium fission. II. SEELMANN-EGGEBERT, W. *Z. Naturforsch*, **2a**, 569–72 (*Oct.*, 1947) *In German.*—The analytical procedures for separating Ru, Rh, Pd, Ag, Cd, In are described. [See Abstr. 1676 (1947)].

545.721 : 621.317.39 1

A paramagnetic oxygen analyser. DYER, C. A. *Sci. Instrum.*, **18**, 696–702 (*Oct.*, 1947).—Descri apparatus for analysing oxygen/air mixtures inhaled airmen under simulated flying conditions. The meth of Klauer *et al.* [*Angew. Chem.*, **54**, 494 (1941)] (cool of hot Pt filament in inhomogeneous magnetic field by local oxygen flow due to its paramagnetism) is us Four Pt filaments 0·0004 in. in dia. form a Wheatst bridge mounted in a small cavity in a heavy brass bl (to equalize temperature); an Alnico V magnet produ inhomogeneous field around two of the filaments. bridge is energized by a 20 kc/s transitron oscillat 3 V applied heats the filaments to about 500°F. unbalance output is amplified and rectified to work indicator and/or recorder. The gas is pumped thro the cell at up to 100 cm³/min, controlled by a fl regulator. The cell is maintained at 125°F by a therm stat. The instrument responds over the range 21 100% oxygen. C. F

545.8 : 539.167.3 = 3 1

A nuclear physics method for determination of sm carbon content in iron. VON ARDENNE, M., AND BE HARD, F. *Z. Phys.*, **122** (*Nos* 9–12) 740–8 (1944) *German.*—Describes a method using radioactive formed by bombardment of samples by protons deuterons. Various difficulties and sources of errors discussed and actual results given. With maxim cleanliness of the sample surface, C contents down 5×10^{-4} can be measured. V. W.

545.844 : 539.163.4 = 3 1

Radiometric adsorption analysis and its application problems of nuclear physics. LINDNER, R. *Z. Nat forsch.*, **2a**, 333–4 (*June*, 1947) *In German.*—Short revi of the chromatographic method applied to radioact substances, pointing out its sensitivity and applicabil to chemically similar substances like Ra–Ba and the r earths. Reference is made to the "hammering-in" effe by which elements produced by radioactive decay in column are stuck to the adsorbent by recoil action. H.

545.844 : 539.172.4 1

The chemical identification of radio-isotopes of n dymium and of element 61. MARINSKY, J. A., GLENDEN L. E., AND CORYELL, C. D. *J. Amer. Chem. Soc.*, 2781–5 (*Nov.*, 1947).—Identification of two unidentifi rare earth radio-isotopes produced in U fission has be accomplished using elution in Amberlite IR–1 absorpti columns with buffered citrate solutions. The order elution is the reverse of atomic number and the positi of elution can be employed in identification. Dec characteristics, genetic relation, and mass assignme are given for the following radio-isotopes: Nd^{147} (days); 61^{147} (3·7 years); Nd^{149} (1·7 hr); 61^{149} (47 h Radiochemical work on the various isotopes of Nd a 61 is reviewed. W. R.

545.844 : 539.172.4 = 3 1

Separation by adsorption of the cerium group eart with particular reference to their isotopes produced U-fission. LINDNER, R. *Z. Naturforsch.*, **2a**, 329– (*June*, 1947) *In German.*—The radiometric adsorpti analysis was applied to U-fission products of the r earths group. A 13-day body could be clearly tinguished from La. Comparison with the 2-hr activ which is obtained by irradiation of Nd and is attribu to element 61 showed an adsorption ratio similar to t obtained for the 19-hr Pr when compared with This makes the identity of the 13-hr body with probable. The 2-hr 61 was also compared with 47

The adsorbability on Al_2O_3 increases in the order 61, Sa, the difference Sa–61 being considerably -Pr. Generally speaking, the separation effects obtained by this method are larger than in the analytical and preparative methods which have so far been in common use. H. L.

CRYSTALLOGRAPHY 548

) : 535.37 *see Abstr.* 1507

) : 535.52 *see Abstr.* 1528

) : 535.543 : 537.226.2 *see Abstr.* 1545

) : 535.6 : 539.16 = 3 1698

) the known sources of radiation suffice for the explana- of the coloration of natural blue rock salt and related ral colours? PRZIBRAM, K. *Acta Phys. Austriaca, o.* 2) 131–6 (1947) *In German.*—It is doubtful if ral radioactivity is sufficient to produce the observed ation of rock salt in the $\sim 10^7$ years available for process, especially if natural decoloration is taken account. It is, however, ample to account for the ration of fluorite. A. J. C. W.

) : 537.533 = 3 *see Abstr.* 1575

0 : 537.533.8 = 3 *see Abstr.* 1580

) : 537.533.9 = 3 1699

amage of crystals by electron beams. KINDER, E. *urwiss*, **34** (*No.* 1) 23–4 (1947) *In German.*—Electron oscope investigation shows that the structures of ral crystals are altered by electron bombardment. ne case of NaCl a mosaic structure is produced, and lar effects are observed with gypsum and molyb- m oxide. In the case of MgO a reduction in the size ne crystals is observed. J. T.

0 : 539.374 = 3 1700

nidirectional glide and its crystallographic meaning. ERT, H. *Z. Phys.*, **124** (*Nos* 1–2) 144–53 (1947) *In man.*—In crystals of low symmetry the shear stress ired to produce glide ||[hkl] need not be the same hat required to produce glide $||[\bar{h}\bar{k}l]$. If glide in one hese directions is easy and in the other very difficult, crystal has unidirectional properties in gliding and tic bending; $KClO_3$ is a good example. The glide erties of $KClO_3$, Al_2SiO_5 and $BaSO_4$ are discussed ne light of their structures. A. J. C. W.

0 : 541.183 : 537.533 = 3 *see Abstr.* 1576

0 : 621.3.011.2 : 669.776 : 537.311.23 *see Abstr.* 1547

33 : 536.424 1701

olymorphism of red phosphorus. ROTH, W. L., DE- T, T. W., AND SMITH, A. J. *J. Amer. Chem. Soc.*, **69**, 1–5 (*Nov.*, 1947).—Amorphous red P undergoes versible exothermic transitions when heated and ds 4 (perhaps 5) polymorphic forms. These changes e been investigated by methods of thermal analysis, ay diffraction, and microscopy. Triclinic, hexagonal tetragonal crystals of red P have been grown from pour; microphotographs and optical data are given. W. R. A.

5 : 539.232 *see Abstr.* 1675

7 : 531.19 : 669.018 = 4 1702

n the statistical thermodynamics of order-disorder sformations in crystal lattices. I. Theory and alloys. ON, J. *Cah. de Phys.* (*No.* 28) 1–22 (*Sept.*, 1945) *In nch.*—A difference equation for the probability v_i that *i*th lattice point is occupied by an atom of type A in alloy of composition AB is developed in the form of eries, the successive terms involving the interaction rgies of atoms in pairs, triplets, quadruplets, etc. pair terms give the Bethe approximation. For β-brass the triplet terms vanish, and inclusion of the quadruplet terms hardly improves the agreement with experiment for the heat capacity. A. J. C. W.

548.7 : 535.375.5 = 4 *see Abstr.* 1516

548.7 : 535.376 *see Abstr.* 1517

548.7 : 539.11 : 535.375.5 = 4 1703

On the natural frequencies of ionic crystals. COUTURE, J. *Rev. Sci., Paris*, **85**, 86–90 (*Jan.* 15, 1947) *In French.*—The field acting on a displaced ion in a uniformly polarized crystal depends on the shape of the crystal, even if the crystal is indefinitely large. To obtain unambiguous results it is necessary to make the polarization vary sinusoidally with a wavelength $\geqslant$ that of the unit cell, but $\leqslant$ that of the crystal. The results of Born [Abstr. 936 (1923)] are then verified for transverse vibrations; there should also be a longitudinal vibration of twice the frequency. Observable effects might be sought in the Raman spectra of non-centrosymmetric crystals and in the absorption spectra of thin lamellae. A. J. C. W.

548.718 : 539.262 : 548.733 *see Abstr.* 1706

548.73 : 532.7 = 3 *see Abstr.* 1456

548.73 : 537.312.62 *see Abstr.* 1559

548.73 : 537.531 : 535.43 1704

Geiger counter measurements of Bragg and diffuse scattering of X-rays by single crystals. LONSDALE, K. *Acta Cryst.*, **1**, 12–20 (*March*, 1948).—The advantages and limitations of the use of Geiger counter equipment for the measurement of scattering intensity from small single crystals are discussed, and the effect of the presence of varying amounts of white radiation in the incident and reflected beams is investigated. Crystals of urea and of oxalic acid dihydrate were studied before and after immersion in liquid air, using Cu *K* and Mo *K* radiations, with A- and Kr-filled counter tubes. It was found that the thermal diffuse scattering is independent of crystal perfection. The ratio of thermal scattering intensity to Bragg scattering for a mosaic crystal increases rapidly with angle of scattering when measured for equivalent groups of thermal waves, and is also much greater for Cu than for Mo radiation. A.

548.731 = 4 1705

Luminosity, resolving power and astigmatism in two-crystal X-ray spectrographs with or without rotatory focusing. PLASENCIA, H. T. *Cah. de Phys.* (*Nos* 29–30) 67–86 (*June*, 1947) *In French.*—See Abstr. 781 (1948). The effect of the dimensions of the crystals and the two collimator slits, and of the method of recording, on the properties mentioned is investigated in considerable detail, and the results are compared with the conclusions of previous workers. There are 22 references. A. J. C. W.

548.733 : 548.718 : 539.262 1706

A rapid mechanical method of transforming Weissenberg X-ray photographs into a reciprocal lattice. VAND, V. *J. Sci. Instrum.*, **24**, 326–8 (*Dec.*, 1947).—The device consists of a rotating table and two frames capable of independent parallel translation. The photograph is attached to one of the frames, whose motion is coupled to the rotation of the table in the same way as the motion of the film is coupled with the rotation of the crystal in

the camera. The other frame has a side-arm supporting a pencil over the rotating table. In use, the first frame is moved so that a spot on the photograph is brought over a fixed indicator line, the second frame is moved so that a curve drawn on a transparent sheet attached to the frame lies over the spot, and the pencil is depressed to make a dot on a sheet of paper attached to the rotating table. Repetition of this process gives the reciprocal lattice. The curve and the indicator line depend on the constants of the camera, the number of the layer line, and the desired scale of the lattice. Their equations are derived. A. J. C. W.

548.736.4 1707

X-ray analysis of the crystal structure of $Pt(NH_3)_2Br_2 . Pt(NH_3)_2Br_4$. BROSSET, C. *Ark. Kemi Min. Geol.*, **25A** (*Paper* 19) 14 *pp.* (1947).—The probable space group is Fddd, $a = 16{\cdot}36$, $b = 15{\cdot}42$, $c = 11{\cdot}06$ kx, with 8 formula units per cell. In the proposed structure, planar $Pt(NH_3)_2Br_2$ and octahedral $Pt(NH_3)_2Br_4$ groups alternate $\parallel c$. Powder data are given. A. J. C. W.

548.736.42 1708

The structure of hydroxylammonium chloride, NH_3OHCl, and hydroxylammonium bromide, NH_3OHBr. JERSLEV, B. *Acta Cryst.*, **1**, 21–7 (*March*, 1948).—Isomorphous, space group C_{2h}^5–$P2_1/c$. Unit cell contains $4NH_3OHX$: $a = 6{\cdot}95$, $b = 5{\cdot}95$, $c = 7{\cdot}70$ Å, $\beta = 120{\cdot}8°$ (Cl); $a = 7{\cdot}29$, $b = 6{\cdot}13$, $c = 8{\cdot}04$ Å, $\beta = 120{\cdot}8°$ (Br). The N and O atoms and the halogen ions occupy general positions 4(*e*). The parameters have been determined. All these atoms and ions are situated close to the planes $(\frac{1}{4}, y, z)$ and $(\frac{3}{4}, y, z)$. The distance between the N and O atoms of the same NH_3OH^+ group is 1·45 Å. A.

548.736.43 1709

On the crystal structure of $Bi_2O_2CO_3$ (bismutite) and $CaBi_2O_2(CO_3)_2$ (beyerite). LAGERCRANTZ, A., AND SILLÉN, L. G. *Ark. Kemi Min. Geol.*, **25A** (*Paper* 20) 21 *pp.* (1947).—Bismutite and beyerite, like many Bi oxy-salts, are tetragonal with $a \sim 3{\cdot}9$ Å, a dimension fixed by close-packing of the O atoms. (The *c* dimensions vary from 6 to 50 Å.) Bismutite has the probable space group I4/mmm, $a = 3{\cdot}867$, $c = 13{\cdot}686$ Å, with two formula units per cell. A structure is suggested in which the Bi atoms are fixed by Patterson synthesis, the O atoms by symmetry, and the CO_3 groups by packing. Beyerite has the same probable space group, $a = 3{\cdot}767$, $c = 21{\cdot}690$ Å. A structure is suggested based on the same considerations, symmetry fixing the Ca atoms also. The synthetic bismutite crystals always carried a $\parallel$ on-growth of an unidentified substance with $a = 3{\cdot}8$, $c = 17{\cdot}1$ Å. Powder data are given. A. J. C. W.

548.736.442 : 537.531 : 535.36 = 4 1710

Observations on diffusion of X-rays by $NaClO_3$ crystals. GARRIDO, J. *Acta Cryst.*, **1**, 3–4 (*March*, 1948) *In French.*—The diffuse scattering of X-rays by crystals of $NaClO_3$ has been studied and the form of the iso-diffusion surfaces associated with the reciprocal lattice poi {200} and {120} has been determined. The study is special interest in the case of $NaClO_3$ on account of t symmetry and structure of this substance.

548.736.453 17

The crystal structure of kalsilite. CLARINGBULL, G. AND BANNISTER, F. A. *Acta Cryst.*, **1**, 42–3 (*Mar* 1948).

548.736.453 17

The structure of 3 : 3′-dichlorobenzidine. TOUSSAI J. *Acta Cryst.*, **1**, 43–4 (*March*, 1948).

548.736.453 17

The crystal structure of the molecular complex 4 : 4′-dinitro-diphenyl with diphenyl. VAN NIEKERK, J. AND SAUNDER, D. H. *Acta Cryst.*, **1**, 44 (*March*, 1948

548.736.453 = 3 17

Synthesis and crystal structure of eucryptite, LiAlSiO WINKLER, H. G. F. *Acta Cryst.*, **1**, 27–34 (*Mar* 1948) *In German.*—Crystals have been prepared sy thetically as hexagonal bipyramids up to 5 mm lor having weak negative birefringence and strong optic activity. The space group is $C6_22$ (or its enantiomor $C6_42$) and the cell dimensions are $a = 5{\cdot}27$, $c = 11{\cdot}25$ The atomic co-ordinates have been determined and sh the structure to be closely related to that of high quar The Al and Si ions occupy the sites of the Si ions quartz, and the small Li ions are accommodated in t channels in the structure.

548.737 17

The structures of pyrimidines and purines. I. A det mination of the structures of 2-amino-4-methyl-6-chlo pyrimidine and 2-amino-4, 6-dichloropyrimidine by X-r methods. CLEWS, C. J. B., AND COCHRAN, W. *A Cryst.*, **1**, 4–11 (*March*, 1948).

548.737 17

The crystal structure of octamethylspiro [5·5] pent siloxane: rotation about the ionic silicon-oxygen bo ROTH, W. L., AND HARKER, D. *Acta Cryst.*, **1**, 34 (*March*, 1948).—Si–O distance $= 1{\cdot}64 \pm 0{\cdot}03$, Si–Cl $1{\cdot}88 \pm 0{\cdot}03$ Å. The $(SiO)_3$ ring is planar and the sha is determined by the tetrahedral Si angles. Evidence presented for the libration of CH_3 groups about silo bonds, and this is interpreted in terms of the io character of the Si–O bond. It is suggested that fr rotation of CH_3 groups about siloxy bonds in the line polymers is responsible for the small intermolecul forces characteristic of these compounds.

548.74 : 537.533.72 *see Abstr.* 1578

MINERALOGY 549

549.211 : 537.56 : 539.16.08 *see Abstr.* 1630

549.211 : 539.16.08 : 535.345 *see Abstr.* 1505

549.514.51 : 539.32 : 537.228.1 *see Abstr.* 1546

GEOPHYSICS 55

ATMOSPHERE . METEOROLOGY 551.5

551.510.4 : 535.338.4 *see Abstr.* 1495

551.510.535 : 523.72 = 3 *see Abstr.* 1399

551.510.535 : 537.568 : 621.396.11 1717

The ionospheric eclipse of October 1, 1940. PIERCE, J. A. *Proc. Inst. Radio Engrs, N.Y.*, **36**, 8–15 (*Jan.*, 1948).—Discusses the variations in the critical frequencies of the various ionospheric layers over Queenstown, South Africa, during the total solar eclipse 1st Oct., 1940, and compares them with the normal-d data. It is shown that recombination and diffusi cannot completely explain the phenomena in the layer, and that the cooling of the atmosphere by t eclipse may be of major importance. A theory of t formation of the *E* layer is proposed to account for t observed variations during the eclipse and at nig Min. values of the apparent recombination coefficients f

E, F_1, and F_2 layers were $1{\cdot}2\times10^{-8}$, 6×10^{-9}, and 0^{-11} cm³/electrons/sec, respectively. Some of the ent data are compared with those, previously un- ished, which resulted from a similar expedition to akstan, U.S.S.R., in 1936. A.

510.535 : 538.566 : 621.396.11 1718

iple magneto ionic splitting of rays reflected from the egion. NEWSTEAD, G. *Nature, Lond.*, **161**, 312 (*Feb.* 948).—Thirty-nine examples have been observed in ir, and one is illustrated and discussed (ordinary and ordinary rays with critical frequencies 7·6 and Mc/s, and a third of 7·0 Mc/s).

510.535 : 621.396.11 1719

n the measurement of ionospheric virtual height at kilocycles. HELLIWELL, R. A. *Phys. Rev.*, **73**, 77 1, 1948).—The virtual height measured by a pulse ique with this frequency on 13th Oct., 1947, varied 91 to 98 Km over a series of readings. The litude of the first order multiple reflection was often d to be > that of the first reflection. W. E. D.

521.1 : 621.396.82 : 523.72 *see Abstr.* 1400

573 1720

atural evaporation from open water, bare soil and s. PENMAN, H. L. *Proc. Roy. Soc. A*, **193** 120–45 *il* 22, 1948).—Two theoretical approaches to evapora- from saturated surfaces are outlined: (*a*) on an dynamic basis in which evaporation is regarded as to turbulent transport of vapour by a process of diffusion, and (*b*) on an energy basis in which oration is regarded as one of the ways of degrading ming radiation. Neither approach is new, but a bination is suggested that eliminates the parameter measured with most difficulty—surface temperature—and enables retrospective theoretical estimates of evaporation rates to be made from standard meteorological data. Experimental work to test these theories shows that the aerodynamic approach is not adequate and an empirical expression is a better description of evaporation from open water. The energy balance is found to be quite successful. Evaporation rates from wet bare soil and from turf with an adequate supply of water are obtained as fractions of that from open water, the fraction for turf showing a seasonal change attributed to the annual cycle of length of daylight. Finally, the experimental results are applied to data published elsewhere, and it is shown that a satisfactory account can be given. A.

551.594.221 : 621.396.821 1721

Some aspects and recent results of electromagnetic effects of thunderstorms. NORINDER, H. *J. Franklin Inst.*, **244**, 109–30 (*Aug.*); 167–208 (*Sept.*, 1947).—The survey of lightning measurements made in Sweden and earlier reported in full [Abstr. 2351 (1947), 627 (1946)] is repeated in slightly modified and abbreviated form without any further information being added. R. H. G.

551.596.1 : 534.222 1722

The propagation of a pulse in the atmosphere. II. PEKERIS, C. L. *Phys. Rev.*, **73**, 145–54 (*Jan.* 15, 1948).—The previous investigation of the dispersion of long waves in the atmosphere [Abstr. 3211 (1939)] has been extended to shorter periods of the order of 1 min. Both the phase velocity and group velocity have been determined. The results are applied to the interpretation of the pressure wave produced by the Great Siberian Meteor and to the pressure oscillations recorded by microbarographs in England. A.

BIOLOGY 57/59

DICAL SCIENCE . HUMAN PHYSIOLOGY 61

766 : 621–52 1723

ome characteristics of a human operator. BATES, . V. *J. Instn Elect. Engrs, Pt IIA*, **94** (*No.* 2) 298–304 7).—Discusses experimental findings which aid an erstanding of the basic limitations of a human rator as an elment in a servo system. It is shown experiments on threshold effects can guide the choice oth display magnification and gear ratio. At least c appear to be required to develop the max. per- tual acuity, but a time greater than this is usually ded in accurately setting a control for full confidence accuracy to develop. The mechanisms of muscular vements are discussed. Reciprocating movements can performed at higher rates than circular movements, hough the latter are less fatiguing. Measurements of mechanical efficiency of man may be worth applying er conditions of heavy work. The conditions of king are shown to resemble multiple-choice reaction- e experiments, with a lag between stimulus and onse that is strictly indeterminable, but which is erally of the order of 0·3 sec. Discontinuity in the rator is demonstrated by the inability to halt a cting movement within 0·2 sec of its start. In practical ign, the advantages are stressed of incorporating the x. possible display magnification; of abolishing any ction in the control, possibly by using two hands; of g high rates of turning; and of introducing as much rtia as the operator can manage. A.

612.85 : 534.75 *see Abstr.* 1477

616-001 : 534.8 1724

Some biological effects of intense high frequency airborne sound. ALLEN, C. H., FRINGS, H., AND RUDNICK, I. *J. Acoust. Soc. Amer.*, **20**, 62–5 (*Jan.*, 1948).—Some experiments have been conducted to determine the effect of intense high frequency airborne sound on mice and a variety of insects. The sound source was a high frequency siren. The frequency used was about 20 kc/s and its acoustic level, in the region where the subjects were placed, was between 160 and 165 db (relative to 10^{-16} watts/cm²). With sufficient exposure—from 10 sec for flies and mosquitoes to 3 or 4 min for roaches and caterpillars—the sound proved lethal in all cases. More detailed work was performed on mice and the roaches. In both cases it was definitely established that the heating produced by sound absorption was sufficient to cause death. In addition to the heating there are other effects, notably tissue rupture, as evidenced by the almost complete destruction of the wings on flies and mosquitoes and the rapid deterioration and final disappearance of the external pinna of a mouse which had received a sub-lethal dose. During observations it has been impossible completely to avoid personal exposure to the sound field and some of the effects observed under these conditions are described. These include momentary dizziness, and heating of exposed parts of the hand. A.

GLASS . CERAMICS 666

666 : 536.41 : 539.213 *see Abstr.* 1326
666 : 539.431 *see Abstr.* 1342

METALLURGY 669

669 : 541.123.3 *see Abstr.* 1685
669.018 : 531.19 : 548.7 = 4 *see Abstr.* 1702

681.4 : 535.8 = 4 *see Abstr.* 1534

PHOTOGRAPHY 77

77.019.2 : 537.523 1725

The electric discharge and the photographic image. BANNER, E. H. W. *Photogr. J.*, **87B**, 142–7 (*Nov.–Dec.*, 1947).—The images obtained on a film placed between two electrodes in air, between which recurrent h.f. current pulses at 30 kVp are passed, are shown to originate in the air spaces between electrode and film and to be due to visible or other radiation excited by ionization of the air in these spaces. The patchiness of the images obtained is ascribed to variations in the degree of contact between the components of the system. No evidence of the images being due to actual electrical conduction through the film was found. A.

77.023 1726

Ultra-rapid processing of photographic materials. BURKIN, A. R. *Photogr. J.*, **87B**, 108–11 (*Sept.–Oct.*, 1947).—Processing methods are described by the use of which pre-hardened films may be completely processed in 6 to 15 sec, and any film in about 30 sec. Detailed procedures and solution formulae are given for use with certain films. A.

77.023.4 : 621.385.833 :
771.534.553 = 3 *see Abstr.* 1730

771.521/.524 1727

Dimensional stability of sensitized photographic material. RAY, A. A. *Photogr. J.*, **87B**, 135–6 (*Nov.–Dec.*, 1947).—A survey is made of the extent to which ordinary photographic films, plates and papers are dimensionally stable, and brief mention is made of special materials in which the base includes Al foil or is waterproofed. A.

771.534.53 1728

The effect of light-absorption on the shape of the photographic H. and D. curve. WEBB, J. H. *J. Opt. Soc. Amer.*, **38**, 27–35 (*Jan.*, 1948).—A theoretical treatment is first given to show how the γ-value of the photographic H. and D. curve varies with the light absorption in an emulsion. The treatment is based on the idea that an emulsion can be subdivided into a number of layers, and that the total H. and D. curve of the entire emulsion can be obtained by summation of the elementary H. and D. curves for the separate layers. Theoretical curves giving γ/D_{max} as a function of the total absorption, or of the thickness, of the emulsion are obtained, which agree with experimental results for several widely different types of emulsions at different wavelengths. Finally, it is shown, by assuming that the maximum density of an emulsion varies linearly with emulsion thickness, that curves predicting γ as a function of emulsion thickness can be obtained. Curves of this type are derived and tested by experiment. A.

771.534.553 : 535.317.1 17

Accuracy of the image. TEARLE, J. L. *Photogr. J* **87B**, 132–4 (*Nov.–Dec.*, 1947).—The resolving power the photographic material, of the lens and of the con bination is considered, and data are given of the variatio in the resolving power of a lens-film combination different apertures of the lens. It is shown that there an optimum aperture at which aberration and diffractio effects cancel out. Variation of resolving power wi separation from lens axis is considered, and it is final concluded that photographic accuracy is greatest wh fine grain films and low aperture lenses are used.

771.534.553 : 77.023.4 : 621.385.833 = 3 17

Suitable developing processes and limiting resolvi power of photographic plates for electron-microsco photos. V. BORRIES, B. *Z. Phys.*, **122** (*Nos* 5–8) 539– (1944) *In German.*—The energy A_B (joules), require to blacken one spot of the picture on a photograph plate, is the suitability-index of an emulsion for electr microscope photos. It is calculated from the sensitivi and grain. By varying the developer chemicals a development time, the values leading to minimum with various emulsions was found. The optimum 3×10^{-12} was found with Agfa hard-blue sensitive pla and methol-hydroquinone developer (time 25 min). T magnification and photos of living substances in electron microscope are discussed. The limiting resolvi power of various plates is theoretically and expe mentally studied. The limiting resolution with sm objects is attained when errors become possible due granularity of the emulsion. V. W.

771.534.581 : 771.535 *see Abstr.* 1731

771.535 : 771.534.581 17

Latent image distribution and Herschel effect. review of Belgian war-time papers on latent image form tion. BERG, W. F. *Photogr. J.*, **87B**, 112–26 (*Sept.–Oc* 1947).—Some 30 papers are reviewed, published Belgium during the war, and dealing with latent ima distribution. The two most important results are: A "deep internal" latent image was found which studied in detail. This requires much heavier exposu than the normal latent image, and is revealed by a stro bleach treatment followed by a developer containing solvent for the Ag halide. (*b*) It is definitely confirm that the Herschel effect is caused by a redistributi rather than a destruction of the latent image Ag.

778.3 : 535.232 = 3 *see Abstr.* 1481

778.34 : 539.164.08 = 4 *see Abstr.* 1638